Filed Pursuant to Rule (424)(b)(3)
Registration No. 333-257930

PROSPECTUS SUPPLEMENT NO. 1
(to Prospectus dated July 14, 2022)

ASTRA SPACE, INC.

Primary Offering Of
15,333,303 Shares of Class A Common Stock

Secondary Offering of
189,026,575 Shares of Class A Common Stock

This prospectus supplement amends and supplements the prospectus dated July 14, 2022 (as supplemented or amended from time to time, the "Prospectus"), which forms a part of our Registration Statement on Form S-1 (No. 333-257930). This prospectus supplement is being filed to update and supplement the information contained in the Prospectus with the information contained in our Current Reports on Form 8-K, filed with the Securities and Exchange Commission (the "Commission") on May 5, 2022, May 5, 2022, May 6, 2022, May 10, 2022, May 13, 2022, May 17, 2022, June 3, 2022, June 13, 2022 and June 13, 2022 (the "Current Reports") and our Quarterly Report on Form 10-Q filed with the Commission on May 5, 2022 (the "Quarterly Report"). Accordingly, we have attached the Current Reports and the Quarterly Report to this prospectus supplement.

The Prospectus and this prospectus supplement also relate to the offer and sale, from time to time, by the selling securityholders named in this prospectus (the "Selling Securityholders"), or any of their permitted transferees, of (i) up to an aggregate of 20,000,000 shares of our Class A common stock that were issued to certain investors (collectively, the "PIPE Investors") in a private placement in connection with the closing of the Business Combination (as defined herein); (ii) 7,500,000 shares of Class A common stock issued to the Sponsor prior to Holicity's initial public offering and registered for sale by the Selling Securityholders; (iii) up to an aggregate of 92,277,793 shares of Class A common stock that were issued to certain affiliates of Astra (collectively, the "Astra Affiliates") pursuant to the Business Combination Agreement (as defined herein); (iv) up to an aggregate 56,239,188 shares of Class A common stock issuable upon conversion (on a one-for-one basis) of shares of our Class B common stock, par value $0.0001 per share ("Class B Common Stock") held by certain Selling Securityholders and (v) up to an aggregate of 7,676,261 shares of our Class A common stock issued in connection with our acquisition of Apollo Fusion, Inc. ("Apollo Fusion"), which closed on July 1, 2021 comprised of (x) 2,558,744 shares of our Class A common stock (the "Initial Apollo Shares") issued to certain of the Selling Securityholders on July 1, 2021, in connection with our merger with Apollo Fusion, Inc. ("Apollo Fusion") and (y) 5,117,517 additional shares of our Class A common stock (the "Additional Apollo Shares") which may be issued to certain of the Selling Securityholders assuming (a) the achievement of all remaining performance milestones set forth in the Apollo Fusion Merger Agreement (as defined herein), (b) we elect to pay all future milestone consideration in shares of our Class A common stock as required by the terms the Apollo Fusion Merger Agreement, and (c) the per share price used to calculate the number of shares of our Class A common stock to be issued is $11.7243, which is the same per share price used to calculate the number of Initial Shares issued to the Selling Securityholders. The Additional Shares have not been earned and are not currently outstanding. The actual number of Additional Shares issued to the selling stockholders could be materially greater or less than 5,117,517 shares of Class A common stock depending whether and to what extent the future performance milestones are met and/or the actual average closing price of our Class A common stock at the time such milestones are achieved. The Prospectus and this prospectus supplement also cover any additional securities that may become issuable by reason of share splits, share dividends or other similar transactions.

Our Class A common stock is listed on Nasdaq under the symbol "ASTR". On July 12, 2022, the closing price of our Class A common stock was $1.34 per share.

This prospectus supplement updates and supplements the information in the Prospectus and is not complete without, and may not be delivered or utilized except in combination with, the Prospectus, including any amendments or supplements thereto. This prospectus supplement should be read in conjunction with the Prospectus and if there is any inconsistency between the information in the Prospectus and this prospectus supplement, you should rely on the information in this prospectus supplement.

Investing in our securities involves risks that are described in the *"Risk Factors"* section beginning on page 13 of the Prospectus.

Neither the SEC nor any state securities commission has approved or disapproved of the securities to be issued under the Prospectus or determined if the Prospectus or this prospectus supplement is truthful or complete. Any representation to the contrary is a criminal offense.

The date of this prospectus supplement is July 14, 2022.

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UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549

FORM 8-K

CURRENT REPORT
Pursuant to Section 13 or 15(d)
of the Securities Exchange Act of 1934

Date of Report (Date of earliest event reported): May 5, 2022

Astra Space, Inc.
(Exact name of Registrant as Specified in Its Charter)

Delaware	001-39426	85-1270303
(State or Other Jurisdiction of Incorporation)	(Commission File Number)	(IRS Employer Identification No.)
1900 Skyhawk Street Alameda, California (Address of Principal Executive Offices)		94501 (Zip Code)

Registrant's Telephone Number, Including Area Code: (866) 278-7217

Check the appropriate box below if the Form 8-K filing is intended to simultaneously satisfy the filing obligation of the registrant under any of the following provisions:

☐ Written communications pursuant to Rule 425 under the Securities Act (17 CFR 230.425)

☐ Soliciting material pursuant to Rule 14a-12 under the Exchange Act (17 CFR 240.14a-12)

☐ Pre-commencement communications pursuant to Rule 14d-2(b) under the Exchange Act (17 CFR 240.14d-2(b))

☐ Pre-commencement communications pursuant to Rule 13e-4(c) under the Exchange Act (17 CFR 240.13e-4(c))

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
Class A common stock, par value $0.0001 per share	**ASTR**	**NASDAQ Global Select Market**

Indicate by check mark whether the registrant is an emerging growth company as defined in Rule 405 of the Securities Act of 1933 (§ 230.405 of this chapter) or Rule 12b-2 of the Securities Exchange Act of 1934 (§ 240.12b-2 of this chapter).

Emerging growth company ☐

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ☐

Item 8.01 Other Events.

On May 5, 2022, Astra Space, Inc. ("Astra") issued a press release announcing that it will host its inaugural Spacetech Day for investors and analysts on Thursday, May 12, 2022 at 9:00 a.m. PT (12:00 p.m. ET). A copy of our press release is included in this current report on Form 8-K as Exhibit 99.1.

Item 9.01 Financial Statements and Exhibits.

(d) Exhibits

Exhibit No.	Description
99.1	Press release issued by Astra Space, Inc. on May 5, 2022
104	Cover Page Interactive Data File (embedded with the Inline XBRL document)

SIGNATURES

Pursuant to the requirements of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned thereunto duly authorized.

Date: May 5, 2022

Astra Space, Inc.

By: /s/ Kelyn Brannon
Name: Kelyn Brannon
Title: Chief Financial Officer

Exhibit 99.1

Astra to Hold Inaugural Spacetech Day on May 12, 2022

ALAMEDA, Calif., May 5, 2022- Astra Space, Inc. ("Astra") (Nasdaq: ASTR) today announced that it will host its inaugural Spacetech Day for investors and analysts on Thursday, May 12, 2022 at 9:00 a.m. PT (12:00 p.m. ET).

Event:	Astra SpaceTech Day
What:	Join us for a live webcast from our Bay Area rocket factory for our inaugural Spacetech Day on May 12, 2022. We'll be sharing information about our products and giving participants a preview of what's next for Astra. We believe that the space economy is at an inflection point akin to the birth of the Internet, both in scale and opportunity. Come see what inspires us every day at Astra Spacetech Day.
When:	Thursday, May 12, 2022, from 9:00 a.m. to 12:00 p.m. PT
Webcast Link:	https://www.astra.com/spacetech-day-2022
Replay:	A webcast replay will be available on the Investor Relations section of Astra's website following the event.

About Astra Space, Inc.

Astra's mission is to improve life on Earth from space by creating a healthier and more connected planet. Today, Astra offers one of the lowest cost-per-launch dedicated orbital launch services of any operational launch provider in the world. Astra delivered its first commercial launch to low Earth orbit in 2021, making it the fastest company in history to reach this milestone, just five years after it was founded in 2016. Astra (NASDAQ: ASTR) was the first space launch company to be publicly traded on Nasdaq. Visit astra.com to learn more about Astra.

Investor Contact:
Ryan Carrithers
investors@astra.com

Media Contact:
Kati Dahm
kati@astra.com

UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549

FORM 8-K

CURRENT REPORT
Pursuant to Section 13 or 15(d)
of the Securities Exchange Act of 1934

Date of Report (Date of earliest event reported): May 5, 2022

Astra Space, Inc.
(Exact name of Registrant as Specified in Its Charter)

Delaware	001-39426	85-1270303
(State or Other Jurisdiction of Incorporation)	(Commission File Number)	(IRS Employer Identification No.)

1900 Skyhawk Street Alameda, California	94501
(Address of Principal Executive Offices)	(Zip Code)

Registrant's Telephone Number, Including Area Code: (866) 278-7217

Check the appropriate box below if the Form 8-K filing is intended to simultaneously satisfy the filing obligation of the registrant under any of the following provisions:

☐ Written communications pursuant to Rule 425 under the Securities Act (17 CFR 230.425)

☐ Soliciting material pursuant to Rule 14a-12 under the Exchange Act (17 CFR 240.14a-12)

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☐ Pre-commencement communications pursuant to Rule 13e-4(c) under the Exchange Act (17 CFR 240.13e-4(c))

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
Class A common stock, par value $0.0001 per share	**ASTR**	**NASDAQ Global Select Market**

Indicate by check mark whether the registrant is an emerging growth company as defined in Rule 405 of the Securities Act of 1933 (§ 230.405 of this chapter) or Rule 12b-2 of the Securities Exchange Act of 1934 (§ 240.12b-2 of this chapter).

Emerging growth company ☐

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ☐

Item 2.02 Results of Operations and Financial Condition.

On May 5, 2022, Astra Space, Inc. (the "Company") issued a press release announcing its financial results for the first quarter ended March 31, 2022.

A copy of the press release is attached hereto as Exhibit 99.1 and is incorporated herein by reference.

The information in Item 2.02 of this Current Report (including the press release furnished as an exhibit hereto) shall not be deemed "filed" for purposes of the Securities Exchange Act of 1934, as amended (the "Exchange Act"), or incorporated by reference in any filing under the Securities Act of 1933, as amended, or Exchange Act, except as shall be expressly set forth by specific reference in such a filing.

Item 9.01 Financial Statements and Exhibits.

(d) Exhibits

Exhibit No.	Description
99.1	Press release issued by Astra Space, Inc. dated May 5, 2022.
104	Cover Page Interactive Data File (embedded with the Inline XBRL document)

SIGNATURES

Pursuant to the requirements of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned thereunto duly authorized.

Date: May 5, 2022

Astra Space, Inc.

By: /s/ Kelyn Brannon
Name: Kelyn Brannon
Title: Chief Financial Officer

Exhibit 99.1

Astra Announces First Quarter 2022 Financial Results

ALAMEDA, California —May 5, 2022—Astra Space, Inc. ("Astra") (Nasdaq: ASTR) today announced financial results for its first quarter ended March 31, 2022.

"This has been a quarter of accelerating investment, customer adoption of our space technology products, and growth in our customer pipeline," said Chris Kemp, Astra's Co-founder, Chairman and CEO. Looking ahead, Astra is honored to have the opportunity to serve NASA to further our vision for a healthier and safer planet as we prepare for a multi-launch campaign out of Cape Canaveral to deploy the NASA TROPICS constellation."

"We continue to make targeted investments to enhance our launch capabilities and product roadmap while managing our cash position. I was impressed with our ability to quickly deploy resources to conclude the expansion of our rocket factory. We look forward to unveiling the progress we've made during Spacetech day next week," stated CFO Kelyn Brannon.

Recent Business Highlights:

- Based on Bryce Tech's Global Orbital Space Launch Report, Astra was tied with the United Launch Alliance (or ULA) for having conducted the fourth most frequent orbital launches during the first quarter of 2022.
- Astra successfully deployed 22 satellites on March 15, 2022, representing our first successful deployment of satellites into Earth orbit.
- To date, Astra has secured orders for 61 Astra Spacecraft Engines.
- Astra conducted its first launch from Cape Canaveral on February 10, 2022.. This was the industry's first launch conducted under the new FAA Part 450 license.
- In January 2022, NASA awarded Astra, along with others, the Venture-Class Acquisition of Dedicated and Rideshare (VADR) contract representing a $300 million opportunity over five years.

First Quarter 2022 Financial Highlights:

For the three months ended March 31, 2022:

- GAAP Net Loss was $(85.7) million.
- Adjusted Net Loss* was $(50.1) million.
- Adjusted EBITDA Loss* of $(47.5) million.
- Capital expenditures, includes additions made during the quarter, totaled $15.1 million.
- Cash and cash equivalents and marketable securities totaled $255.2. Cash and cash equivalents were $161.5 million and marketable securities totaled $93.7 million as of March 31, 2022.

*** Denotes Non-GAAP financial measure. Refer to "Explanation of Adjusted (or Non-GAAP) Financial Measures" later in this press release for reconciliation of GAAP to Non-GAAP financial measures.**

Second Quarter 2022 Outlook

As of May 5, 2022, we are providing guidance for the second quarter 2022 based on current market conditions and expectations. We emphasize that the guidance is subject to various important cautionary factors referenced in the section entitled "Forward-Looking Statements" below and our annual report on Form 10-K for the year ended December 31, 2021, including risks and uncertainties associated with the ongoing COVID-19 pandemic as well as the Russia, Ukraine conflict and their potential impact on our business.

For the second quarter ending June 30, 2022, we currently expect:

- Adjusted EBITDA Loss* between $(58) million and $(64) million.
- Depreciation and Amortization between $2.9 million and $3.2 million.
- Stock-based compensation between $15 million and $18 million.
- Cash taxes of approximately zero.
- Basic shares outstanding between 267 million and 270 million.
- Capital expenditures between $18 million and $23 million.

*** Denotes Non-GAAP financial measure. Refer to "Explanation of Adjusted (or Non-GAAP) Financial Measures" later in this press release for reconciliation of GAAP to Non-GAAP financial measures.**

Conference Call Information

In conjunction with this announcement, Astra will host a conference call for investors at 1:30 p.m. PT (4:30 p.m. ET) today to discuss first quarter results and our outlook for the second quarter ending June 30, 2022. The live webcast and a replay of the webcast will be available on the Investor Relations section of Astra's website: https://investor.astra.com/news-and-events/events-and-presentations.

About Astra Space, Inc.

Astra's mission is to improve life on Earth from space by creating a healthier and more connected planet. Today, Astra offers one of the lowest cost-per-launch dedicated orbital launch services of any operational launch provider in the world. Astra delivered its first commercial launch to low Earth orbit in 2021, making it the fastest company in history to reach this milestone, just five years after it was founded in 2016. Astra (NASDAQ: ASTR) was the first space launch company to be publicly traded on Nasdaq. Visit astra.com to learn more about Astra.

Forward Looking Statements

Certain statements made in this press release are "forward-looking statements". Forward-looking statements may be identified by the use of words such as "anticipate", "believe", "expect", "estimate", "plan", "outlook", and "project" and other similar expressions that predict or indicate future events or trends or that are not statements of historical matters. These forward-looking statements reflect the current analysis of existing information and are subject to various risks and uncertainties. As a result, caution must be exercised in relying on forward-looking statements. Due to known and unknown risks, actual results may differ materially from Astra's expectations or projections, including the following factors, among others: (i) the failure to meet projected development and launch targets, including as a result of the decisions of governmental authorities or other third parties not within our control, weather and other suboptimal conditions that may it difficult to perform a launch attempt; (ii) changes in applicable laws or regulations; (iii) the ability of Astra to meet its financial and strategic goals, due to, among other things, competition; (iv)

the ability of Astra to pursue a growth strategy and manage growth profitability; (v) the possibility that Astra may be adversely affected by other economic, business, and/or competitive factors; (vi) the effect of the COVID-19 pandemic on Astra, (vii) the ability to manage its cash outflows during its business operations and (vii) other risks and uncertainties described herein, as well as those risks and uncertainties discussed from time to time in other reports and other public filings with the Securities and Exchange Commission by Astra.

Explanation of Non-GAAP (or Adjusted) Financial Measures

This press release includes information about Free Cash Flow, Adjusted Net Loss and Adjusted EBITDA (collectively the "non-GAAP financial measures"), all of which are non-GAAP financial measures. These non-GAAP financial measures are measurements of financial performance that are not prepared in accordance with U.S. generally accepted accounting principles and computational methods may differ from those used by other companies. Non-GAAP financial measures are not meant to be considered in isolation or as a substitute for comparable GAAP measures and should be read only in conjunction with Astra's consolidated financial statements prepared in accordance with GAAP. Non-GAAP financial measures are reconciled to their most comparable GAAP measures in the table set forth in this release.

We believe that both management and our investors benefit from referring to these non-GAAP financial measures in planning, forecasting and analyzing future periods. Specifically, our management uses these non-GAAP financial measures in planning, monitoring and evaluating our financial and operational decision making and as a means to evaluate period-to-period comparisons. Our management recognizes that the non-GAAP financial measures have inherent limitations because of the excluded items described below. We believe that providing the non-GAAP financial measures, together with the reconciliation to GAAP measures, helps investors make comparisons between Astra and other companies in our industry. In making any comparisons to other companies in our industry, investors need to be aware that companies use different non-GAAP measures to evaluate their financial performance. Investors should pay close attention to the specific definition being used and to the reconciliation between such measure and the corresponding GAAP measure provided by each company under applicable SEC rules.

We define Free Cash Flow as cash used in operating activities including cash used for capital expenditures. Adjusted Net Loss differs from GAAP Net Loss in that it excludes the following items: (a) loss on change in fair value of contingent consideration, (b) stock-based compensation, (c) cash earnout compensation cost related to the acquisition of Apollo Fusion, and (d) other special items. During the first quarter, other special items primarily related to amortization of licensed intellectual property, employee COVID-19 testing expenses and payroll taxes.

We define Adjusted EBITDA as Adjusted Net Loss, excluding the following items: (a) interest expense and interest income, (b) income tax expense, (c) loss on marketable securities, and (d) depreciation and amortization. We are unable to predict with reasonable certainty the ultimate outcome of these exclusions without unreasonable effort.

Investor Contacts:
Ryan Carrithers, Astra investors@astra.com

Media Contact:
Kati Dahm, Astra kati@astra.com

Astra Space, Inc.
Condensed Consolidated Statement of Operation
(Unaudited, in thousands except per share data)

	Three Months Ended		
	March 31,		December 31,
	2022	2021	2021
Revenues	$ 3,911	$ —	$ —
Cost of revenues	11,014	—	—
Gross loss	(7,103)	—	—
Research and development	37,927	12,196	36,239
Sales and marketing	4,764	64	1,882
General and administrative	20,986	12,394	24,040
Loss (gain) on change in fair value of contingent consideration	15,500	—	(4,700)
Total operating expenses	79,177	24,654	57,461
Operating loss	**(86,280)**	**(24,654)**	**(57,461)**
Interest income (expense), net	174	(535)	25
Other income (expense), net	393	—	6,169
Loss on extinguishment of convertible notes	—	(133,783)	—
Loss before taxes	**(85,713)**	**(158,972)**	**(51,267)**
Income tax (benefit) expense	—	—	(2)
Net loss	**$ (85,713)**	**$ (158,972)**	**$ (51,265)**
Adjustment to redemption value on Convertible Preferred Stock	—	(1,011,726)	—
Net loss attributable to common stockholders	**$ (85,713)**	**$(1,170,698)**	**$ (51,265)**
Basic and Diluted Loss per Share			
Weighted average basic and diluted shares - Class A	208,113	16,209	202,982
Loss per share	$ (0.33)	$ (18.57)	(0.20)
Weighted average basic and diluted shares - Class B	55,539	46,846	56,232
Loss per share	$ (0.33)	$ (18.57)	(0.20)

Astra Space, Inc.
Condensed Consolidated Balance Sheets
(Unaudited, in thousands)

	March 31, 2022	December 31, 2021
Summary Balance Sheet Data:		
Assets:		
Cash and cash equivalents	$ 161,521	$ 325,007
Marketable securities	93,669	—
Trade accounts receivable	432	1,816
Inventories	8,701	7,675
Prepaid and other current assets	11,233	12,238
Total current assets	**275,556**	**346,736**
Property, plant and equipment, net	79,415	66,316
Right-of-use asset	8,979	9,079
Goodwill	58,251	58,251
Intangible assets, net	17,106	17,921
Other non-current assets	625	721
Total assets	**439,932**	**499,024**
Liabilities & Stockholders' Equity:		
Accounts payable	6,200	9,122
Operating lease obligation, current portion	1,790	1,704
Accrued expenses and other current liabilities	29,318	29,899
Total current liabilities	**37,308**	**40,725**
Operating lease obligation, net of current portion	7,039	7,180
Other non-current liabilities	27,099	14,599
Total liabilities	**71,446**	**62,504**
Total stockholders' equity	**368,486**	**436,520**
Total liabilities and stockholders' equity	**439,932**	**499,024**

Astra Space, Inc.
Summary Cash Flow Data
(Unaudited, in thousands)

	March 31,		December 31,
	2022	2021	2021
Summary Cash Flow Data:			
Cash used in operating activities	$ (48,274)	$ (13,677)	$ (34,780)
Capital expenditures	(20,942)	(324)	(19,629)
Free cash flow (non-GAAP)	(69,216)	(14,001)	(54,409)
Cash used in investing activities	(115,683)	(3,524)	(19,779)
Cash provided by financing activities	471	29,138	914

Astra Space, Inc.
Reconciliation of GAAP Financial Measures to Non-GAAP Financial Measures
(Unaudited, in thousands)

	March 31,		December 31,
	2022	2021	2021
GAAP net loss	**$(85,713)**	**$(158,972)**	**$ (51,265)**
Stock based compensation	17,041	10,333	19,278
(Gain) / loss on change in fair value of contingent consideration	15,500	—	(4,700)
Apollo cash earnout compensation	1,333	—	4,449
Loss on extinguishment of convertible notes	—	133,783	—
Gain on change in fair value of warrants	—	—	(5,234)
Other special items	1,693	—	—
Adjusted net loss	**(50,146)**	**(14,856)**	**(37,472)**
Interest (income) Expense	(174)	535	(25)
Income tax (benefit) expense	—	—	(2)
Loss on marketable securities	67	—	—
Depreciation & Amortization	2,775	888	1,431
Adjusted EBITDA	**$(47,478)**	**$ (13,433)**	**$ (36,068)**

UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, DC 20549

FORM 10-Q

(Mark One)

☒ **QUARTERLY REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the quarterly period ended March 31, 2022

OR

☐ **TRANSITION REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934**

For the transition period from _____ to _____

Commission File Number: 001-39426

ASTRA SPACE, INC.
(Exact Name of Registrant as Specified in its Charter)

Delaware	**85-1270303**
(State or other jurisdiction of incorporation or organization)	**(I.R.S. Employer Identification No.)**
1900 Skyhawk Street Alameda, CA	**94501**
(Address of principal executive offices)	**(Zip Code)**

Registrant's telephone number, including area code: (866) 278-7217

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
Class A Common Stock, par value $0.0001 per share	**ASTR**	**The NASDAQ Global Select Market**

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes ☒ No ☐

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit such files). Yes ☒ No ☐

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, smaller reporting company, or an emerging growth company. See the definitions of "large accelerated filer," "accelerated filer," "smaller reporting company," and "emerging growth company" in Rule 12b-2 of the Exchange Act.

Large accelerated filer	☒	Accelerated filer	☐
Non-accelerated filer	☐	Smaller reporting company	☐
Emerging growth company	☐		

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ☐

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Exchange Act). Yes ☐ No ☒

As of May 2, 2022, the registrant had 208,614,084 shares of Class A common stock, $0.0001 par value per share, outstanding and 55,539,188 shares of Class B common stock, $0.0001 par value per share, outstanding.

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PART I—FINANCIAL INFORMATION

Item 1. Condensed Consolidated Financial Statements (unaudited)

ASTRA SPACE, INC.
CONDENSED CONSOLIDATED BALANCE SHEETS
(In thousands, except share data)
(Unaudited)

	As of	
	March 31, 2022	December 31, 2021
ASSETS		
Current assets:		
Cash and cash equivalents	$ 161,521	$ 325,007
Marketable securities	93,669	—
Trade accounts receivable	432	1,816
Inventories	8,701	7,675
Prepaid and other current assets	11,233	12,238
Total current assets	275,556	346,736
Non-current assets:		
Property, plant and equipment, net	79,415	66,316
Right-of-use asset	8,979	9,079
Goodwill	58,251	58,251
Intangible assets, net	17,106	17,921
Other non-current assets	625	721
Total assets	$ 439,932	$ 499,024
LIABILITIES AND STOCKHOLDERS' EQUITY		
Current liabilities:		
Accounts payable	$ 6,200	$ 9,122
Operating lease obligation, current portion	1,790	1,704
Accrued expenses and other current liabilities	29,318	29,899
Total current liabilities	37,308	40,725
Non-current liabilities:		
Operating lease obligation, net of current portion	7,039	7,180
Other non-current liabilities	27,099	14,599
Total liabilities	71,446	62,504
Commitments and Contingencies (Note 11)		
STOCKHOLDERS' EQUITY		
Founders convertible preferred stock, $0.0001 par value; 1,000,000 shares authorized; none issued and outstanding as of March 31, 2022 and December 31, 2021	—	—
Class A common stock, $0.0001 par value; 400,000,000 shares authorized; 208,610,490 and 207,451,107 shares issued and outstanding as of March 31, 2022 and December 31, 2021, respectively	22	22
Class B common stock, $0.0001 par value; 65,000,000 shares authorized; 55,539,188 and 55,539,189 shares issued and outstanding as of March 31, 2022 and December 31, 2021, respectively	6	6
Additional paid in capital	1,862,709	1,844,875
Accumulated other comprehensive loss	(155)	—
Accumulated deficit	(1,494,096)	(1,408,383)
Total stockholders' equity	368,486	436,520
Total liabilities and stockholders' equity	$ 439,932	$ 499,024

The accompanying notes are an integral part of these unaudited condensed consolidated financial statements.

ASTRA SPACE, INC.
CONDENSED CONSOLIDATED STATEMENTS OF OPERATIONS
(In thousands, except share and per share data)
(Unaudited)

	For The Three Months Ended March 31,	
	2022	2021
Revenues	$ 3,911	$ —
Cost of revenues	11,014	—
Gross loss	(7,103)	—
Operating expenses:		
Research and development	37,927	12,196
Sales and marketing	4,764	64
General and administrative	20,986	12,394
Loss on change in fair value of contingent consideration	15,500	—
Total operating expenses	79,177	24,654
Operating loss	(86,280)	(24,654)
Interest income (expense), net	174	(535)
Other income (expense), net	393	—
Loss on extinguishment of convertible notes	—	(131,908)
Loss on extinguishment of convertible notes attributable to related parties	—	(1,875)
Loss before taxes	(85,713)	(158,972)
Income tax (benefit) provision	—	—
Net loss	$ (85,713)	$ (158,972)
Adjustment to redemption value on Convertible Preferred Stock	—	(1,011,726)
Net loss attributable to common stockholders	$ (85,713)	$ (1,170,698)
Net loss per share:		
Weighted average number of shares of Class A common stock outstanding – basic and diluted	208,112,630	16,206,813
Net loss per share of Class A common stock – basic and diluted	$ (0.33)	$ (18.57)
Weighted average number of shares of Class B common stock outstanding – basic and diluted	55,539,188	46,845,555
Net loss per share of Class B common stock – basic and diluted	$ (0.33)	$ (18.57)

The accompanying notes are an integral part of these unaudited condensed consolidated financial statements.

ASTRA SPACE, INC.
CONDENSED CONSOLIDATED STATEMENTS OF COMPREHENSIVE LOSS
(In thousands)
(Unaudited)

	For The Three Months Ended March 31,	
	2022	2021
Net loss	$ (85,713)	$ (158,972)
Other comprehensive loss:		
Unrealized loss on available-for-sale marketable securities	(155)	—
Total comprehensive loss	$ (85,868)	$ (158,972)

The accompanying notes are an integral part of these unaudited condensed consolidated financial statements.

ASTRA SPACE, INC.
CONDENSED CONSOLIDATED STATEMENTS OF STOCKHOLDERS' EQUITY
Three Months Ended March 31, 2022
(In thousands, except share data)
(Unaudited)

	Class A Common Stock		Class B Common Stock		Additional Paid in Capital	Accumulated Other Comprehensive Loss	Accumulated Deficit	Total Stockholders' Equity
	Shares	Amount	Shares	Amount				
Balance as of December 31, 2021	207,451,107	$ 22	55,539,189	$ 6	$1,844,875	$ —	$(1,408,383)	$ 436,520
Stock-based compensation	—	—	(1)	—	17,041	—	—	17,041
Issuance of common stock under equity plans	1,159,383	—	—	—	793	—	—	793
Unrealized loss on available-for-sale marketable securities	—	—	—	—	—	(155)	—	(155)
Net loss	—	—	—	—	—	—	(85,713)	(85,713)
Balance as of March 31, 2022	208,610,490	$ 22	55,539,188	$ 6	$1,862,709	$ (155)	$(1,494,096)	$ 368,486

The accompanying notes are an integral part of these unaudited condensed consolidated financial statements.

ASTRA SPACE, INC.
CONDENSED CONSOLIDATED STATEMENTS OF TEMPORARY EQUITY AND STOCKHOLDERS' DEFICIT
Three Months Ended March 31, 2021
(In thousands, except share data)
(Unaudited)

	Convertible Preferred Stock		Common Stock (Pre-combination Astra)		Founders Preferred Stock		Additional Paid in Capital	Accumulated Deficit	Total Stockholders' Deficit
	Shares	Amount	Shares	Amount	Shares	Amount			
Balance as of December 31, 2020	90,768,286	$ 108,829	62,961,258	$ 6	12,302,500	$ 1	$ 50,282	$ (190,697)	$ (140,408)
Cumulative effect adjustment due to adoption of ASU 2020-06	—	—	—	—	—	—	(9,719)	691	(9,028)
Stock-based compensation	—	—	—	—	—	—	2,177	—	2,177
Exercise of options	—	—	498,807	—	—	—	228	—	228
Issuance of Series C Convertible Preferred Stock, net of issuance costs	28,498,141	221,943	—	—	—	—	—	—	—
Conversion of Founders Convertible Preferred Stock to Series C Convertible Preferred Stock	5,073,576	—	—	—	(5,073,576)	—	8,156	—	8,156
Adjustment to redemption value on Convertible Preferred Stock	—	1,011,726	—	—	—	—	(51,131)	(960,595)	(1,011,726)
Net loss	—	—	—	—	—	—	—	(158,972)	(158,972)
Balance as of March 31, 2021	124,340,003	$ 1,342,498	63,460,065	$ 6	7,228,924	$ 1	$ (7)	$ (1,309,573)	$ (1,309,573)

The accompanying notes are an integral part of these unaudited condensed consolidated financial statements.

ASTRA SPACE, INC.
CONDENSED CONSOLIDATED STATEMENTS OF CASH FLOWS
(In thousands)
(Unaudited)

	Three Months Ended March 31,	
	2022	2021
Cash flows from operating activities:		
Net loss	$ (85,713)	$ (158,972)
Adjustments to reconcile net loss to cash flows used in operating activities		
Stock-based compensation	17,041	10,333
Depreciation	1,960	888
Amortization of intangible assets	815	—
Inventory net realizable value write downs	5,500	—
Non-cash lease expense	352	170
Accretion (amortization) of marketable securities purchased at a premium (discount)	67	—
Loss on change in fair value of contingent consideration	15,500	—
Loss on extinguishment of convertible notes	—	131,908
Loss on extinguishment of convertible notes attributable to related parties	—	1,875
Amortization of convertible note discounts	—	315
Amortization of convertible note discounts attributable to related parties	—	55
Changes in operating assets and liabilities:		
Trade accounts receivable	1,383	—
Inventories	(6,526)	(370)
Prepaid and other current assets	1,005	(4,213)
Other non-current assets	97	—
Accounts payable	125	734
Lease liabilities	(306)	73
Accrued expenses and other current liabilities	(72)	3,330
Other non-current liabilities	498	197
Net cash used in operating activities	$ (48,274)	$ (13,677)
Cash flows from investing activities:		
Acquisition of trademark	(850)	(3,200)
Purchases of marketable securities	(93,891)	—
Purchases of property, plant and equipment	(20,942)	(324)
Net cash used in investing activities	$ (115,683)	$ (3,524)
Cash flows from financing activities:		
Proceeds from issuance of Series C preferred stock	—	30,000
Issuance cost of Series C preferred stock	—	(90)
Repayments on term loans	—	(300)
Repayments on equipment advances	—	(700)
Proceeds from stock issued under equity plans	79	228
Proceeds from Employee Stock Purchase Plan	392	—
Net cash provided by financing activities	$ 471	$ 29,138
Net increase (decrease) in cash and cash equivalents	$ (163,486)	$ 11,937
Cash and cash equivalents at beginning of period	325,007	10,611
Cash and cash equivalents at end of period	$ 161,521	$ 22,548
Non-cash activities:		
Assets acquired included in accounts payable and accrued expenses and other current liabilities	$ 3,252	$ 492
Change in redemption value of Convertible Preferred Stock		1,011,726
Supplemental disclosures of cash flow information:		
Cash paid for interest	$ —	$ 80

The accompanying notes are an integral part of these unaudited condensed consolidated financial statements

ASTRA SPACE, INC.
NOTES TO UNAUDITED CONDENSED CONSOLIDATED FINANCIAL STATEMENTS

Note 1 — Description of Business, Basis of Presentation and Significant Accounting Policies

Description of Business

Astra Space, Inc. designs, tests, manufactures and operates the next generation of launch services and space services and products that it expects to enable a new generation of global communications, earth observation, precision weather monitoring, navigation, and surveillance capabilities. Astra Space, Inc.'s mission is to Improve Life on Earth from Space™ through greater connectivity and more regular observation and to enable a wave of innovation in low Earth orbit by expanding our space platform offerings.

Holicity Inc. ("Holicity") was originally incorporated in Delaware and was established as a special purpose acquisition company, which completed its initial public offering in August 2020. On June 30, 2021 (the "Closing Date"), Holicity consummated a business combination (the "Business Combination") pursuant to the Business Combination Agreement dated as of February 2, 2021 (the "BCA"), by and among Holicity, Holicity Merger Sub Inc., a wholly owned subsidiary of Holicity ("Merger Sub"), and Astra Space Operations, Inc. ("pre-combination Astra"). Immediately upon the consummation of the Business Combination, Merger Sub merged with and into pre-combination Astra with pre-combination Astra surviving the merger as a wholly owned subsidiary of Holicity. Holicity changed its name to "Astra Space, Inc." and pre-combination Astra changed its name to "Astra Space Operations, Inc."

Unless the context otherwise requires, "we", "us", "our", "Astra" and the "Company" refers to Astra Space, Inc., the combined company and its subsidiaries following the Business Combination and Astra Space Operations, Inc. prior to the Business Combination. See Note 3 — Acquisitions for further discussion of the Business Combination. The Company's Class A common stock is listed on the Nasdaq under the symbol "ASTR".

Basis of Presentation and Principles of Consolidation

The accompanying condensed consolidated financial statements include the accounts of Astra and its subsidiaries, and have been prepared in conformity with accounting principles generally accepted in the United States of America ("GAAP") as determined by the Financial Accounting Standards Board ("FASB") Accounting Standards Codification ("ASC") and pursuant to the rules and regulations of the U.S. Securities and Exchange Commission ("SEC") for financial reporting. The condensed consolidated financial statements included herein are unaudited, and reflect all adjustments which are, in the opinion of management, of a normal recurring nature and necessary for a fair statement of the results for the periods presented. The December 31, 2021 condensed consolidated balance sheet data were derived from Astra's audited consolidated financial statements included in its Annual Report on Form 10-K for year ended December 31, 2021 as filed with the SEC. All intercompany transactions and balances have been eliminated in consolidation. The operating results for the three months ended March 31, 2022 are not necessarily indicative of the results that may be expected for the year ending December 31, 2022, or for any other future period.

Business Combination

On June 30, 2021, the Business Combination pursuant to the BCA, by and among Holicity, Merger Sub, and pre-combination Astra, was accounted for as a reverse recapitalization as pre-combination Astra was determined to be the accounting acquirer under ASC 805. The determination is primarily based on the evaluation of the following facts and circumstances:

- the equity holders of pre-combination Astra hold the majority of voting rights in the Company;
- the board of directors of pre-combination Astra represent a majority of the members of the board of directors of the Company;
- the senior management of pre-combination Astra became the senior management of the Company; and
- the operations of pre-combination Astra comprise the ongoing operations of the Company.

In connection with the Business Combination, outstanding common stock and preferred convertible stock of the pre-combination Astra was converted into common stock of the Company, par value of $0.0001 per share, representing a recapitalization, and the net assets of the Company were acquired and recorded at historical cost, with no goodwill or intangible assets recorded. Pre-combination Astra was deemed to be the predecessor and the condensed consolidated assets and liabilities and results of operations prior to the Closing Date are those of pre-combination Astra. Reported shares and earnings per share available to common stockholders, prior to the Business Combination, have been retroactively restated as shares reflecting the exchange ratio established in the BCA. The number of shares of preferred stock was also retroactively restated based on the exchange ratio. See Note 3 — Acquisitions for additional information.

Liquidity

The accompanying unaudited condensed consolidated financial statements have been prepared on a going concern basis. The Company has historically funded its operations primarily by equity financings and convertible promissory notes prior to the Business Combination and subsequently funded its operations through cash proceeds obtained as part of the Business Combination and related private placement. As of March 31, 2022, the Company's existing sources of liquidity included cash and cash equivalents of $161.5 million and marketable securities of $93.7 million. The Company has a limited history of operations and has incurred negative cash flows from operating activities and loss from operations in the past as reflected in the accumulated deficit of $1,494.1 million as of March 31, 2022. The Company expects to continue to incur operating losses due to the investments it intends to make in its business, including the development of its products and services. Management continuously evaluates opportunities to strengthen the Company's financial position, including through the issuance of additional equity securities or by entering into new financing arrangements, as appropriate. However, the Company has adequate liquidity that it expects will be sufficient to fund operating and capital expenditure requirements through at least twelve (12) months from the date of issuance of these financial statements.

Impact of the COVID-19 Pandemic

The Company has been actively monitoring the ongoing COVID-19 pandemic situation and its impact on the Company's business. The COVID-19 pandemic had disrupted everyday life and markets worldwide, leading to significant business and supply-chain disruption, as well as broad-based changes in supply and demand. The Company has been diligent in testing and monitoring our employees, and there have been disruptions in productivity, although these disruptions have not resulted in suspension of our manufacturing facilities. However, beginning in the first quarter of 2021, there has been a trend in many parts of the world of increasing availability and administration of vaccines against COVID-19, as well as an easing of restrictions on social, business, travel and government activities and functions. On the other hand, infection rates and regulations continue to fluctuate in various regions and there are ongoing global impacts resulting from the pandemic, including challenges and increases in costs for logistics and supply chains, such as increased intermittent supplier delays and a shortfall of semiconductor supply. Ultimately, we cannot predict the duration of the COVID-19 pandemic. We will continue to monitor macroeconomic conditions to remain flexible and to optimize and evolve our business as appropriate and deploy our production, workforce and other resources accordingly.

Use of Estimates and Judgements

The preparation of the condensed consolidated financial statements in conformity with GAAP requires management to make estimates and assumptions that affect the reported amounts of assets and liabilities in the condensed consolidated financial statements and accompanying notes. The Company bases these estimates on historical experience and on various other assumptions that it believes are reasonable under the circumstances, the results of which form the basis for making judgments about the carrying amounts of assets and liabilities that are not readily apparent from other sources. Actual results could differ significantly from those estimates. Significant items subject to such estimates and assumptions include the valuation of goodwill and intangible assets, inventory valuation, stock-based compensation, pre-combination Astra common stock, useful lives of intangible assets and fixed assets, deferred tax assets, income tax uncertainties, contingent consideration and other contingencies.

Significant Accounting Policies

Other than those described below, there have been no changes to the Company's significant accounting policies described in the Company's Annual Report on Form 10-K for the year ended December 31, 2021, that have had a material impact on its unaudited condensed consolidated financial statements and related notes.

Marketable securities. Marketable securities consist of U.S. Treasury securities, corporate debt securities, commercial paper, and asset backed securities. The Company classifies marketable securities as available-for-sale at the time of purchase and reevaluates such classification as of each balance sheet date. Interest receivable on these securities is presented in other current assets on the condensed consolidated balance sheets. All marketable securities are recorded at their estimated fair values. When the fair value of a marketable security declines below its amortized cost basis, the carrying value of the security will be reduced to its fair value if it is more likely than not that management is required to sell the impaired security before recovery of its amortized basis, or management has the intention to sell the security. If neither of these conditions are met, the Company determines whether any portion of the decline is due to credit losses. Any portion of that decline attributable to credit losses, to the extent expected to be nonrecoverable before the sale of the security, is recognized in the Company's condensed consolidated statement of operations. When the fair value of the security declines below its amortized cost basis due to changes in interest rates, such amounts are recorded in accumulated other comprehensive income (loss) and are recognized in the Company's condensed consolidated statement of operations only if the Company sells or intends to sell the security before recovery of its cost basis. Realized gains and losses are determined based on the specific identification method and are reported in other income (expense), net in the Company's condensed consolidated statements of operations.

Note 2 — Revenues

The Company recognizes revenue to reflect the transfer of promised goods or services to customers in an amount that reflects the consideration to which the Company expects to be entitled in exchange for those goods or services. Through its current and anticipated offerings, the Company expects to generate revenue by providing the following goods or services:

Launch Services — To provide rapid, global, and affordable launch services to satellite operators and governments in partnership with third-party spaceport providers globally. Our launch services include services tied directly to our launch along with complementary services that are not part of our fixed pricing for which we charge a separate fee. The Company currently operates its launches from Pacific Spaceport Complex in Kodiak, Alaska and Cape Canaveral Space Force Station in Cape Canaveral, Florida. The Company plans to add additional launch sites in diverse locations based on its customers' inclination requirements and as the Company increases the frequency of launches.

Space Products — To design and provide space products based on the customers' needs for a successful satellite launch and other products that the Company may sell in the future. Currently the Company offers two in-space electric propulsion systems.

Space Services — To invest in building the Company's portfolio of space services, which includes communication service and constellation services, which will be based on the Company's network of spacecraft that customers can access for use in their business. Specifically, the Company's space services encompass all aspects of hosted satellite and constellation services, including hosting customer payloads onto its spacecraft, and delivering services, such as communication and other services, to customers from its space platform.

As of March 31, 2022, the Company has only entered into contracts for launch services and space products. As of March 31, 2022, the Company is in early stages of developing its space services offerings which includes communication service and constellation services. The Company's contracts may provide customers with termination for convenience clauses, which may or may not include termination penalties. In some contracts, the size of the contractual termination penalty increases closer to the scheduled launch date. At each balance sheet date, the Company evaluates each contract's termination provisions and the impact on the accounting contract term, i.e., the period in which the Company has enforceable rights and obligations. This includes evaluating whether there are termination penalties and if so, whether they are considered substantive. The Company applies judgment in determining whether the termination penalties are substantive.

Recognition of Revenue

The work performed by the Company in fulfilling launch services and space products performance obligations is not expected to create an asset to the customer since the launch vehicle that is built to deliver the customer's payload into orbit will not be owned by the customer or the propulsion systems that are built to thrust the customers' satellite into orbit will not be owned by the customer until they are delivered to the customer. The Company recognizes revenue at a point in time upon satisfaction of the performance obligations under its launch services and space products agreements. The Company recognized $3.9 million of revenues for the three months ended March 31, 2022 under its launch services agreements. No revenue had been recognized for the three months ended March 31, 2021.

Contracts with governmental entities involving research and development milestone activities do not represent contracts with customers under ASC 606 and as such, amounts received are recorded in other income (expense), net in the condensed consolidated statements of operations. The Company recorded $0.4 million for the three months ended March 31, 2022. No such income was recorded for the three months ended March 31, 2021.

Contract Balances and Remaining Performance Obligations

Contract balances. Contract assets and liabilities represent the differences in the timing of revenue recognition from the receipt of cash from the Company's customers and billings. Contract assets reflect revenue recognized and performance obligations satisfied in advance of customer billing. Contract liabilities relate to payments received in advance of the satisfaction of performance under the contract. Receivables represent rights to consideration that are unconditional. Such rights are considered unconditional if only the passage of time is required before payment of that consideration is due. The Company had no contract assets as of March 31, 2022 and December 31, 2021. The Company had contract liabilities of $10.5 million and $10.4 million as of March 31, 2022 and December 31, 2021, respectively. The Company recognized revenue of $2.3 million during the three months ended March 31, 2022 that was included in the contract liabilities balance at the beginning of the period. No revenue was recognized for the three months ended March 31, 2021.

Remaining performance obligations. Revenue allocated to remaining performance obligations represents the transaction price allocated to the performance obligations that are unsatisfied, or partially unsatisfied. It includes unearned revenue and amounts that will be invoiced and recognized as revenue in future periods and does not include contracts where the customer is not committed. Customers are not considered committed when they are able to terminate their contractual obligations to us without payment of a substantive penalty under the contract. Many of the Company's contracts allow the customer to terminate the contract prior to launch or delivery without a substantive penalty, and therefore the enforceable contract is for a period less than the stated contractual term. Further, the Company has elected not to disclose the value of unsatisfied performance obligations for contracts with an original expected length of one year or less. The Company had unsatisfied performance obligations of $23.8 million as of March 31, 2022, the majority of which is expected to be recognized in 2022.

Note 3 — Acquisitions

Acquisition of Apollo Fusion, Inc.

On July 1, 2021, or the Apollo Acquisition Date, the Company, through its wholly owned indirect subsidiary, merged with Apollo Fusion, Inc. ("Apollo"). The results of Apollo's operations have been included in the unaudited condensed consolidated financial statements since that date. Apollo designs, tests, manufactures and operates propulsion modules to enable satellites to orbit in space.

The fair value of the consideration paid as of July 1, 2021, was $70.8 million, net of cash acquired (the "Apollo Merger"), which consisted of the following:

Purchase Consideration (in thousands)	
Cash paid for outstanding Apollo common stock and options	$19,926
Fair value of Astra Class A common stock issued	33,008
Fair value of contingent consideration	18,400
Total purchase consideration	71,334
Less: cash acquired	566
Total purchase consideration, net of cash acquired	$ 70,768

The fair value of the shares of Class A common stock issued in the Apollo Merger was determined based on the closing market price of the Company's Class A common stock on the Apollo Acquisition Date.

The vesting of all unvested stock options of Apollo granted prior to the Apollo Acquisition Date were accelerated prior to the acquisition and were then cancelled in exchange for a right of each option-holder to cash, equity and contingent consideration based on their pro-rata percentage, assuming all stock options of Apollo had been exercised.

The contingent consideration requires the Company to pay $75.0 million of additional consideration to Apollo's former shareholders and option-holders, if Apollo meets certain customer revenue related milestones over a two and half year period ending on December 31, 2023. The contingent consideration is earned, which is a combination of total contract value and relevant payout ratio, if the contract with the customer is entered into after the acquisition date and 25% of revenue under the contract is recognized by December 31, 2023 under ASC 606. Contingent consideration is payable on a quarterly basis based on the milestones achieved. The fair value of the contingent consideration arrangement at the acquisition date was $18.4 million. The Company estimated the fair value of the contingent consideration using a Monte Carlo simulation model. This fair value measurement is based on significant inputs not observable in the market and thus represents a Level 3 measurement as defined in ASC 820. As of March 31, 2022, the contingent consideration recognized increased to $29.2 million as a result of changes in forecasted revenues subject to milestone payments and the passage of time. The Company has recognized $10.8 million in cumulative net losses on changes in fair value of contingent consideration from the Apollo Acquisition Date, of which $15.5 million in loss was recognized in the condensed consolidated statement of operations for the three months ended March 31, 2022.

An additional $10.0 million of cash ("Cash Earnout") will be paid to employees of Apollo that joined Astra, subject to certain vesting conditions, as amended. The Cash Earnout is accounted for as compensation expense over the requisite service period in the post-acquisition period as the payment is subject to the employee's continued employment with the Company. The Company has recognized $7.1 million in compensation cost from the Apollo Acquisition Date, of which $1.3 million in compensation cost was recognized in research and development expense in the condensed consolidated statement of operations for the three months ended March 31, 2022. The earned, but unpaid, amount of the Cash Earnout of $3.4 million and $3.9 million is recorded within accrued expenses and other current liabilities in the condensed consolidated balance sheet as of March 31, 2022 and December 31, 2021, respectively.

In addition, the Company awarded 1,047,115 Performance Stock Units ("PSUs") to employees of Apollo that joined Astra, subject to certain performance-based milestones, as amended, and other vesting provisions. The PSUs are accounted for as compensation expense over the requisite service period in the post-acquisition period as the vesting of PSUs is subject to time-based and performance-based vesting conditions. See Note 15 — Stock-based Compensation for additional information.

We allocated the fair value of the purchase consideration to the tangible assets, liabilities and intangible assets acquired, based on their fair values. The excess purchase price over those fair values is recorded as goodwill. Our valuation assumptions of acquired assets and assumed liabilities require significant estimates, especially with respect to intangible assets. The final purchase consideration allocation is presented in the following table.

(in thousands)	Fair Value
Inventory	$ 131
Prepaid and other current assets	796
Property, plant and equipment	996
Right of use assets	163
Goodwill	58,251
Intangible assets	15,350
Other non-current assets	75
Total assets acquired	75,762
Accounts payable	(950)
Accrued expenses and other current liabilities	(1,939)
Operating lease obligation	(163)
Other non-current liabilities	(1,942)
Total liabilities assumed	(4,994)
Fair value of net assets acquired	$ 70,768

Goodwill is primarily attributable to the assembled workforce and anticipated synergies expected from the integration of the Apollo business. The synergies include operating efficiencies, and other strategic benefits projected to be achieved as a result of the Apollo Merger. Goodwill is not deductible for tax purposes.

There were no revenues recorded during the three months ended March 31, 2022 related to Apollo. It was impracticable to determine the effect on net income attributable to Apollo as we had integrated a substantial portion of Apollo into our ongoing operations during the year.

Intangible Assets

	Fair Value (in thousands)	Weighted-Average Amortization Periods (in years)
Developed technology	$ 12,100	6
Customer contracts and related relationships	2,900	3
Order backlog	200	1
Tradename	150	2
Total identified intangible assets	$ 15,350	

Developed technology relates to propulsion modules. The Company valued the developed technology using the relief-from-royalty method under the income approach. This method is based on the application of a royalty rate to forecasted revenue that are expected to be generated by developed technology. The economic useful life was determined based on the technology cycle related to the developed technology, as well as the cash flows over the forecast period.

Customer contracts and related relationships represent the fair value of future projected revenue that will be derived from sales of products to existing customers of Apollo. Customer contracts and related relationships were valued using the multi-period excess earnings method under the income approach. This method reflects the present value of the projected cash flows that are expected to be generated by the customer contracts and related relationships less charges representing the contribution of other assets to those cash flows. The economic useful life was determined based on historical customer turnover rates.

Order backlog represents business under existing contractual obligations. The fair value of backlog was determined using the multi-period excess earnings method under the income approach based on expected operating cash flows from future contractual revenue. The economic useful life was determined based on the expected life of the backlog and the cash flows over the forecast period.

Trade name relates to the “Apollo” trade name. The fair value was determined by applying the relief-from-royalty method under the income approach. This method is based on the application of a royalty rate to forecasted revenue under the trade name. The economic useful life was determined based on the expected life of the trade name and the cash flows anticipated over the forecast period.

The Company believes the amounts of purchased intangible assets recorded above represent the fair values of, and approximate the amounts a market participant would pay for, these intangible assets as of the Apollo Acquisition Date.

Reverse Recapitalization.

On June 30, 2021, pre-combination Astra Space, Inc. and Holicity Inc. consummated the Business Combination contemplated by the BCA, with pre-combination Astra surviving the merger as a wholly owned subsidiary of Holicity. Upon consummation of the Business Combination, Holicity changed its name to Astra Space, Inc., and pre-combination Astra changed its name to Astra Space Operations, Inc.

Immediately following the Business Combination, there were 198,090,903 shares of Class A common stock and 56,239,189 shares of Class B common stock issued and outstanding with a par value of $0.0001. Additionally, there were outstanding options to purchase an aggregate of 5,993,412 shares of Class A common stock and outstanding warrants to purchase 15,813,829 shares of Class A common stock.

The Business Combination was accounted for as a reverse recapitalization in accordance with GAAP as pre-combination Astra has been determined to be the accounting acquirer. Under this method of accounting, while Holicity was the legal acquirer, it has been treated as the "acquired" company for financial reporting purposes. Accordingly, the Business Combination was treated as the equivalent of pre-combination Astra issuing stock for the net assets of Holicity, accompanied by a recapitalization. The net assets of Holicity were stated at historical cost, with no goodwill or other intangible assets recorded. Operations prior to the Business Combination are those of pre-combination Astra. Reported shares and earnings per share available to holders of the Company's common stock, prior to the Business Combination, have been retroactively restated as shares reflecting the exchange ratio established in the BCA (approximately one pre-combination Astra share to 0.665 of the Company's shares).

The most significant change in the post-combination Company's reported financial position and results was an increase in cash, net of transactions costs, of $463.6 million, including $200.0 million in gross proceeds from the private placements (the "PIPE"). In connection with the Business Combination, $25.2 million of transaction costs were paid on the Closing Date. Additionally, on the Closing Date, the Company repaid all the outstanding debt except for Paycheck Protection Program note. Refer to Note 6 – Long-term Debt.

Upon closing of the Business Combination, the shareholders of Holicity, including Holicity founders, were issued 37,489,019 shares of Class A common stock. In connection with the Closing, holders of 10,981 shares of common stock of Holicity were redeemed at a price per share of $10.00. In connection with the Closing 20,000,000 shares were issued to PIPE investors at a price per share of $10.00.

The number of shares of Class A common stock issued immediately following the consummation of the Business Combination were:

Common stock of Holicity	29,989,019
Holicity founder shares	7,500,000
Shares issued in PIPE	20,000,000
Business Combination and PIPE shares	57,489,019
Pre-combination Astra shares	140,601,884
Total shares of Class A common stock immediately after Business Combination	198,090,903

In addition, in connection with the consummation of the Business Combination, 56,239,189 shares of Class B common stock were issued to two executive officers and founders of the Company: Chris Kemp and Adam London in exchange for an aggregate 73,699,647 shares of common stock and an aggregate 10,870,562 shares of Founders Preferred Stock of pre-combination Astra.

Note 4 — Supplemental Financial Information

Inventories

in thousands	As of March 31, 2022	As of December 31, 2021
Raw materials	$ 8,032	$ 5,775
Work in progress	669	941
Finished goods	—	959
Inventories	$ 8,701	$ 7,675

There were $5.5 million of inventory net realizable value write downs recorded within cost of revenues during the three months ended March 31, 2022. There were no inventory net realizable value write downs recorded during the three months ended March 31, 2021.

Property, Plant and Equipment, net

Presented in the table below are the major classes of property, plant and equipment:

in thousands	As of March 31, 2022	As of December 31, 2021
Construction in progress	$ 9,693	$ 39,246
Computer and software	3,418	3,092
Leasehold improvements	54,343	14,177
Research equipment	11,716	8,935
Production equipment	11,746	10,442
Furniture and fixtures	1,035	1,001
Total property, plant and equipment	91,951	76,893
Less: accumulated depreciation	(12,536)	(10,577)
Property, plant and equipment, net	$ 79,415	$ 66,316

Depreciation expense amounted to $2.0 million and $0.9 million for the three months ended March 31, 2022 and 2021, respectively. No impairment charges were recorded for the three months ended March 31, 2022 and 2021.

Accrued Expenses and Other Current Liabilities

in thousands	As of March 31, 2022	As of December 31, 2021
Employee compensation and benefits	$ 6,516	$ 9,927
Contract liabilities, current portion	10,307	10,162
Fair value of contingent consideration, current portion	3,500	—
Construction in progress related accruals	1,365	3,726
Accrued expenses	4,837	3,464
Other (miscellaneous)	2,793	2,620
Accrued expenses and other current liabilities	$ 29,318	$ 29,899

Other Non-Current Liabilities

in thousands	As of March 31, 2022	As of December 31, 2021
Fair value of contingent consideration, net of current portion	$ 25,700	$ 13,700
Contract liabilities, net of current portion	149	149
Other (miscellaneous)	1,250	750
Other non-current liabilities	$ 27,099	$ 14,599

Note 5 — Intangible Assets

in thousands	Carrying Amount	Accumulated Amortization	Net Book Value
As of March 31, 2021:			
Definite-lived intangible assets			
Developed technology	$12,100	$ 1,513	$10,587
Customer contracts and related relationship	2,900	725	2,175
Order backlog	200	150	50
Trade names	150	56	94
Intangible assets subject to amortization	15,350	2,444	12,906
Indefinite-lived intangible assets			
Trademarks	4,200	—	4,200
Total	$19,550	$ 2,444	$17,106

in thousands	Carrying Amount	Accumulated Amortization	Net Book Value
As of December 31, 2021:			
Definite-lived intangible assets			
Developed technology	$12,100	$ 1,008	$11,092
Customer contracts and related relationship	2,900	483	2,417
Order backlog	200	100	100
Trade names	150	38	112
Intangible assets subject to amortization	15,350	1,629	13,721
Indefinite-lived intangible assets			
Trademarks	4,200	—	4,200
Total	$19,550	$ 1,629	$17,921

Based on the amount of intangible assets as of March 31, 2022, the expected amortization expense for each of the next five years and thereafter is as follows:

in thousands	Expected Amortization Expense
2022 (remainder)	$ 2,343
2023	3,021
2024	2,500
2025	2,017
2026	2,017
Thereafter	1,008
Total intangible assets	$ 12,906

Note 6 — Long-Term Debt

There is no short-term and long-term debt outstanding as of March 31, 2022 and December 31, 2021. In connection with the Business Combination, all outstanding debt with the exception of the Paycheck Protection Program note was paid on June 30, 2021. Refer to Note – 3 Acquisitions. In August 2021, the Company's application for forgiveness of Paycheck Protection Program was approved in the full amount of the outstanding principal balance and accrued interest.

Term Loan and Equipment Advances

On December 25, 2018, the Company entered into a loan agreement (the "2018 Loan Agreement") with Silicon Valley Bank ("SVB"). Pursuant to the 2018 Loan Agreement, the Company could borrow up to a total of $3.0 million term loans ("2018 Term Loans") and $7.0 million equipment loans ("2018 Equipment Advances") with access period ended on April 30, 2020 for 2018 Term Loans and June 30, 2019 for 2018 Equipment Advances. Amounts borrowed under the 2018 Loan Agreement were repaid prior to or on June 30, 2021.

In connection with the execution of the 2018 Loan Agreement, the Company entered into a 2018 warrant agreement which granted certain warrants to SVB (the "Warrants"). The Warrants were issued in one initial tranche on December 25, 2018 and three subsequent tranches in 2019 each time the Company made an additional debt draw under the 2018 Loan Agreement. Pursuant to the warrant agreement, SVB had the option to purchase an aggregate of 480,520 shares of Class A common stock. The warrants had a weighted average exercise price of $0.24 per share and were exercisable for a period of 10 years. The Company accounted for all the Warrants issued as equity instruments since the Warrants were indexed to the Company's common shares and met the criteria for classification in stockholders' equity. In July 2021, SVB exercised all the outstanding Warrants and the Company issued 472,113 shares of Company's Class A Common Stock, net of exercise price.

Paycheck Protection Program Note ("PPP Note")

On April 20, 2020, the Company received loan proceeds of approximately $4.9 million under the Paycheck Protection Program ("PPP"), offered by the U.S. Small Business Administration (the "SBA") pursuant to Title 1 of the Coronavirus Aid, Relief and Economic Security Act (the "CARES Act"). The PPP Note proceeds were available to be used to pay for payroll costs, including salaries, commissions, and similar compensation, group health care benefits, and paid leaves, rent and utilities, and mortgage interest payments. The PPP Note was subject to forgiveness to the extent proceeds were used for payroll costs, including payments required to continue group health care benefits, and certain rent, utility, and mortgage interest expenses (collectively, "Qualifying Expenses"), pursuant to the terms and limitations of the PPP Note.

The Company used the PPP Note amount intended for Qualifying Expenses. In the first quarter of the year ended December 31, 2021, the Company submitted a forgiveness application to its lender seeking full forgiveness of the PPP Note. On August 24, 2021, the Company received notice from the lender that the Small Business Administration has approved the application for forgiveness of the PPP Note in the full amount.

Convertible Notes

Issuance of Convertible Notes

From June 2019 through July 2019, the Company issued $14.8 million of convertible promissory notes (the "June 2019 Convertible Notes") to certain investors. The June 2019 Convertible Notes matured on June 10, 2021 and accrued interest at 2.37% or 2.13%, compounded annually on basis of 360-days year of twelve 30-day months. Principal and any accrued but unpaid interest were due and payable at maturity.

From October 2019 through December 2020, the Company issued $45.0 million of convertible promissory notes (the "October 2019 Convertible Notes" and collectively with the June 2019 Convertible Notes, the "Convertible Notes") to certain investors. The October 2019 Convertible Notes matured on October 1, 2021 and accrued interest at 1.69%, 1.59% or 1.85%, compounded annually on basis of 360-days year of twelve 30-day months. Principal and any accrued but unpaid interest were due and payable at maturity.

Settlement of Convertible Notes

On January 28, 2021, the Company entered a stock purchase agreement with certain investors to close the issuance of Series C convertible preferred stock at a cash purchase price of $6.62 per share and settle all outstanding Convertible Notes through Series C convertible preferred stock at a conversion price of $1.33 or $1.71 per share ("Series C Financing"). The Company issued 38,323,292 shares of Series C Convertible Preferred Shares (pre-combination) for conversion of outstanding Convertible Notes of $61.0 million.

The June 2019 Convertible Notes were settled pursuant to the contractual conversion upon the Next Equity Financing feature with such financing yielding at least $20 million in a single transaction. The Company credited the net carrying amount of the June 2019 Convertible Notes of $14.5 million, including any unamortized debt discount, to Series C convertible preferred stock with no gain or loss recognized.

The October 2019 Convertible Notes were settled based on negotiated terms between the Company and the note holders as the Series C Financing did not meet the definition of Next Equity Financing for the October 2019 Convertible Notes. The Company assessed the economics of the settlement of the October 2019 Convertible Notes and concluded that it should be treated as a privately negotiated debt redemption/settlement transaction where debt extinguishment accounting should be applied. Therefore, the Company derecognized the net carrying amount, including any unamortized debt discount, of the October 2019 Convertible Notes of $42.6 million and recognized the Series C convertible preferred stock issued specifically to settle the October 2019 Convertible Notes at fair value as the reacquisition consideration. Accrued and unpaid interest of $0.6 million was settled and not paid in cash and therefore it was included in calculating the extinguishment loss. The difference between the net carrying amount of the October 2019 Convertible Notes, plus accrued and unpaid interest, and the reacquisition consideration was recorded as a loss on extinguishment in the condensed consolidated statement of operations for the three months ended March 31, 2021.

The Company issued in aggregate 26,727,308 shares of Series C convertible preferred stock (pre-combination) to settle the October 2019 Convertible Notes. The fair value of the Series C convertible preferred stock was determined to be $176.9 million using the cash purchase price of $6.62 per share on January 28, 2021. These October 2019 Convertible Notes had a carrying amount plus accrued and unpaid interest of $43.2 million upon settlement. The difference of $133.8 million was recognized as a loss on extinguishment on the Company's condensed consolidated statement of operations for the three months ended March 31, 2021.

Note 7 — Warrant Liabilities

As part of Holicity's initial public offering ("IPO") in 2020, Holicity issued 9,999,976 warrants to third party investors, and each whole warrant entitled the holder to purchase one share of the Company's Class A common stock at an exercise price of $11.50 per share (the "Public Warrants"). Simultaneously with the closing of the IPO, Holicity completed the private sale of 5,333,333 warrants to Holicity's sponsor ("Private Placement Warrants") and each Private Placement Warrant allowed the sponsor to purchase one share of the Company's Class A common stock at $11.50 per share.

The Private Placement Warrants and the shares of common stock issuable upon the exercise of the Private Placement Warrants were not transferable, assignable or salable until after the completion of a Business Combination, subject to certain limited exceptions. Additionally, the Private Placement Warrants were exercisable for cash or on a cashless basis, at the holder's option, and were non-redeemable so long as they were held by the initial purchasers or their permitted transferees. If the Private Placement Warrants were held by someone other than the initial purchasers or their permitted transferees, the Private Placement Warrants will be redeemable by the Company and exercisable by such holders on the same basis as the Public Warrant.

The Company accounted for Public Warrants and Private Placement Warrants as liability-classified instruments based on an assessment of the warrant's specific terms and applicable authoritative guidance in FASB ASC 480, Distinguishing Liabilities from Equity ("ASC 480") and ASC 815, Derivatives and Hedging ("ASC 815"). Specifically, the exercise of the Public and Private Placement Warrants may be settled in cash upon the occurrence of a tender offer or exchange that involves 50% or more of the Company's Class A shareholders. Because not all of the Company's shareholders needed to participate in such tender offer or exchange to trigger the potential cash settlement and the Company did not control the occurrence of such an event, the Company concluded that the Public Warrants and Private Placement Warrants did not meet the conditions to be classified in equity. Since the Public and Private Placement Warrants met the definition of a derivative under ASC 815, the Company recorded these warrants as liabilities on the balance sheet at fair value upon the closing of the Business Combination, with subsequent changes in their respective fair values recognized in the consolidated statement of operations at each reporting date.

On November 26, 2021, the Company issued a notice of redemption to redeem all of its Public Warrants and Private Placement Warrants ("Redeemable Warrants") outstanding as of December 27, 2021. Under the Warrant Agreement, the Company was entitled to redeem not less than all of the outstanding Redeemable Warrants at a Redemption Price of $0.10 per Redeemable Warrant, provided that the last reported sales price of the Class A common stock had been at least $10.00 per share on the trading day prior to the date on which notice of redemption is given, and further provided that there is an effective registration statement covering the shares of Class A common stock issuable upon exercise of the Redeemable Warrants and a current prospectus relating thereto, available through the Redemption Date.

Under the notice of redemption, Company required holders of the Redeemable Warrants to exercise their Warrants on a cashless basis, (the "Cashless Exercise Option") and holders were not permitted to exercise Redeemable Warrants by paying the $11.50 per share exercise price in cash. Pursuant to the Cashless Exercise Option, an exercising holder of the Redeemable Warrants received a number of shares of Class A common stock (the "Exercise Shares") equal to the quotient obtained by dividing the product of the number of shares of Class A common stock underlying the Redeemable Warrants, multiplied by the excess of the fair market value of the Class A common stock over the exercise price of the Redeemable Warrants by the fair market value. Since the fair market value was less than the exercise price of the Redeemable Warrants, no Exercise Shares would have been issued if a holder would have elected to exercise its Redeemable Warrant pursuant to the Cashless Exercise Option. Alternatively, holders of the Redeemable Warrants were entitled to elect to receive, in lieu of the redemption price or exercising their Redeemable Warrants pursuant to the Cashless Exercise Option, 0.2560374 shares of Class A common stock for each Redeemable Warrants.

In connection with the redemption, the holders of 9,413,895 Public Warrants and 5,333,333 Private Placement Warrants elected to receive, in lieu of the redemption price, an aggregate 3,775,709 shares of Class A common stock at 0.2560374 shares of Class A Common Stock per Warrant. A total of 586,075 Public Warrants remained unexercised as of December 27, 2021 and the Company redeemed the Public Warrants for a redemption price of $0.10 per Redeemable Warrant on December 27, 2021.

Note 8 — Income Taxes

We compute our provision for income taxes by applying the estimated annual effective tax rate to year-to-date income from recurring operations and adjust the provision for discrete tax items recorded in the period.

There has historically been no federal or state provision for income taxes because the Company has incurred operating losses and maintains a full valuation allowance against its net deferred tax assets. For the three months ended March 31, 2022 and 2021, the Company recognized no provision for income taxes consistent with the losses incurred and the valuation allowance against the deferred tax assets.

Utilization of net operating loss carryforwards, tax credits and other attributes may be subject to future annual limitations due to the ownership change limitations provided by Section 382 of the Internal Revenue Code and similar state provisions.

The Company files income tax returns in the U.S. federal jurisdiction and various states. The Company is not currently under examination by income tax authorities in federal, state or other jurisdictions. All tax returns will remain open for examination by the federal and state authorities for three and four years, respectively, from the date of utilization of any net operating loss or credits.

Note 9 — Leases

The Company has operating leases for warehouse, production, and office facilities and equipment. Lease contracts have remaining lease terms of less than one year to seven years, some of which include options to extend the term by up to 5 years. The Company included renewal options that are reasonably certain to be exercised as part of the lease term. Additionally, some lease contracts include termination options. The Company does not expect to exercise the majority of termination options and generally excludes such options when determining the term of leases.

The operating lease costs were $0.5 million and $0.3 million for the three months ended March 31, 2022 and 2021, respectively.

The weighted average remaining lease term was 6.33 years and 6.68 years as of March 31, 2022 and December 31, 2021, respectively. The weighted average discount rate was 7.34% as of each of March 31, 2022 and December 31, 2021.

Cash flows arising from lease transactions for the three months ended March 31, 2022 and 2021 were as follows (in thousands):

in thousands	2022	2021
Cash paid for amounts included in the measurements of lease liabilities — operating cash flows	$(460)	$ (10)
Right-of-use assets obtained in exchange for operating leases liabilities	$ 251	$—

Future minimum lease payments under non-cancellable leases in effect as of March 31, 2022 are as follows (in thousands):

Year Ended December 31,	Operating Leases
2022 (remainder)	$ 1,412
2023	1,790
2024	1,677
2025	1,655
2026	1,642
Thereafter	2,840
Total future undiscounted minimum lease payments	$ 11,016
Less: imputed Interest	2,187
Total reported lease liability	$ 8,829

Note 10 — Fair Value Measurements

The Company measures its financial assets and liabilities at fair value each reporting period using a fair value hierarchy that prioritizes the use of observable inputs and minimizes the use of unobservable inputs when measuring fair value. A financial instrument's classification within the fair value hierarchy is based upon the lowest level of input that is significant to the fair value measurement. Three levels of inputs may be used to measure fair value, as follows:

Level 1 Observable inputs, such as quoted prices in active markets for identical assets or liabilities;

Level 2 Inputs, other than quoted prices in active markets, that are observable either directly or indirectly; and

Level 3 Unobservable inputs in which there is little or no market data, which require the reporting entity to develop its own assumptions.

The Company uses the market approach to measure fair value for its financial assets and liabilities. The market approach uses prices and other relevant information generated by market transactions involving identical or comparable assets or liabilities.

The carrying amounts of Company's financial instruments, which include cash equivalents, accounts receivable, prepaid expenses, other current assets, accounts payable, accrued liabilities and certain other current liabilities approximate fair value because of their short-term maturities.

The following table presents information about the Company's assets and liabilities that are measured at fair value on a recurring basis (in thousands):

	As of March 31, 2022			
Description	**Level 1**	**Level 2**	**Level 3**	**Total**
Assets				
Cash equivalents:				
Money market account	$ 6,102	$ —	$ —	$ 6,102
Marketable securities				
US Treasury securities	22,975	—	—	22,975
Corporate Debt securities	—	24,232	—	24,232
Commercial Paper	—	35,887	—	35,887
Asset Backed Securities	—	10,575	—	10,575
Total financial assets	$29,077	$70,694	$ —	$99,771
Liabilities:				
Contingent consideration	$ —	$ —	$29,200	$29,200
Total financial liabilities	$ —	$ —	$29,200	$29,200

	As of December 31, 2021			
Description	**Level 1**	**Level 2**	**Level 3**	**Total**
Assets				
Cash equivalents:				
Money market account	$100,000	$ —	$ —	$100,000
Total financial assets	$100,000	$ —	$ —	$100,000
Liabilities:				
Contingent consideration	$ —	$ —	$13,700	$ 13,700
Total financial liabilities	$ —	$ —	$13,700	$ 13,700

The following table presents a summary of the changes in fair value of the Company's Level 3 financial instruments:

in thousands	**Contingent Consideration**
Fair value as of December 31, 2021	$ 13,700
Loss on change in fair value of contingent consideration	15,500
Fair value as of March 31, 2022	$ 29,200

The fair value of contingent consideration related to Apollo acquisition is classified as Level 3 financial instruments. To determine the fair value of the contingent consideration, the Company used a Monte Carlo simulation model. The Monte Carlo simulation considered assumptions including revenue volatilities, risk free rates, discount rates and additional revenue discount rate. Additionally, other key assumptions included forecasted revenues from new customers and probability of achieving it. The following table sets forth the range of inputs for the significant assumptions utilized to determine the fair value of contingent consideration as of March 31, 2022:

	As of March 31, 2022	As of December 31, 2021
Risk-free interest rate	1.62%	0.56%
Expected revenue volatility	18.5%	20.0%
Revenue discount rate	6.50%	5.50%
Discount rate	3.50%	3.25%

Note 11 — Commitments and Contingencies

Legal Proceedings

The Company is party to ordinary and routine litigation incidental to its business. On a case-by-case basis, the Company engages inside and outside counsel to assess the probability of potential liability resulting from such litigation. After making such assessments, the Company makes an accrual for the estimated loss only when the loss is probable, and an amount can be reasonably estimated.

On February 9, 2022, a putative class action was filed in the United States District Court for the Eastern District of New York styled Artery v. Astra Space, Inc. et al., Case No. 1:22-cv-00737 (E.D.N.Y.) (the "Artery Action"). The complaint alleges that the Company and certain of its current and former officers violated provisions of the Securities Exchange Act of 1934 with respect to certain statements concerning the Company's capabilities and business prospects. The complaint seeks unspecified damages on behalf of a purported class of purchasers of the Company's securities between February 2, 2021 and December 29, 2021. On March 23, 2022, a second putative class action was filed in the United States District Court for the Eastern District of New York styled Riley v. Astra Space, Inc., et al., Case No. 1:22-cv-01591 (E.D.N.Y.) (the "Riley Action," with the Artery Action, the "Securities Actions"). The Riley Action alleges the same claims, based upon similar facts, against the same defendants, and seeks the same damages. The Company expects that the two cases will be consolidated into a single action. Defendants intend to move to dismiss once the Court appoints a lead plaintiff and an amended complaint is filed. The Company believes that the Securities Actions are without merit and intend to defend them vigorously. Due to the early stage of the cases, neither the likelihood that a loss, if any, will be realized, nor an estimate of the possible loss or range of loss, if any, can be determined.

On March 8, 2022, a stockholder derivative suit was filed in the United States District Court for the State of Delaware styled Meyer, et al., v. Kemp, et al., Case No. 22-cv-00308 (D. Del.). The complaint asserts claims against the current members of our board of directors and certain of our current and former officers, for breach of their fiduciary duty, waste, unjust enrichment, and contribution under the Securities Exchange Act of 1934, based upon the conduct alleged in the Artery Action. The plaintiffs seek monetary damages in favor of the Company in an unstated amount, reformation of the Company's corporate governance and internal procedures, restitution including a disgorgement of any compensation, profits or other benefits achieved, and reimbursement of the plaintiffs' reasonable fees and costs, including attorney's fees. The Company believes that the case is without merit and intends to defend it vigorously. Due to the early stage of the case, neither the likelihood that a loss, if any, will be realized, nor an estimate of the possible loss or range of loss, if any, can be determined.

The Company has tendered defense of each of the three foregoing claims under its Directors' and Officers' policy. The retention under this policy is $20 million.

Purchase Commitments

On May 25, 2021, the Company entered a contract with a supplier to purchase components. The Company is obligated to purchase $22.5 million of components over 60 months. The Company may terminate the supply agreement by paying 50% of the remaining purchase commitment at any point during the contract term. The Company made total purchases of $0.8 million under the contract of which $0.4 million related to purchases made during the three months ended March 31, 2022. The Company also made advance payments of $0.4 million under the contract during the three months ended March 31, 2022.

Note 12 — Convertible Preferred Stock

Convertible Preferred Stock

From pre-combination Astra's inception until the consummation of the Business Combination, approximately $100.2 million of cash capital contributions was raised, net of issuance costs, through the issuance of three rounds of convertible preferred equity.

The three classes of convertible preferred stock of pre-combination Astra were: Series A convertible preferred stock, Series B convertible preferred stock and Series C convertible preferred stock (collectively, the "Convertible Preferred Stock"). Immediately before the consummation of the Business Combination, the Convertible Preferred Stock of pre-combination Astra consisted of:

Series	Shares Outstanding (pre-combination Astra)	Liquidation Price Per Share	Conversion Price Per Share	Annual Noncumulative Dividend Rights Per Share
A	65,780,540	$ 0.243233	$ 0.243233	$ 0.019459
B	70,713,123	1.333008	1.333008	0.106640
C	50,483,785	6.620970	6.620970	0.529680
Total	186,977,448			

Upon the consummation of the Business Combination in June 2021, 186,977,448 shares of Convertible Preferred Stock (pre-combination Astra) converted into 124,340,003 shares of Class A common stock of the Company. The Company no longer had Convertible Preferred Stock authorized, issued or outstanding subsequent to the close of Business Combination in June 2021.

On January 28, 2021, concurrent with Series C Financing, the Company amended its certificate of incorporation to add a merger with a special purpose acquisition company ("SPAC Transaction") as one of the defined Deemed Liquidation events. In addition, upon triggering of the Deemed Liquidation events, the holders of the Convertible Preferred Stock were entitled to receive the greater of their liquidation preference per share and the as converted value per share. As of March 31, 2021, the Company assessed the probability of a SPAC Transaction to be probable and therefore, the Convertible Preferred Stock were considered probable of becoming redeemable.

Subsequent measurement of Convertible Preferred Stock was then required for the three months ended March 31, 2021. The Company elected to apply the current redemption value method to measure the redeemable Convertible Preferred Stock. Under the method, changes in the redemption value were recognized immediately as they occurred and the carrying value of the Convertible Preferred Stock was adjusted to the redemption value at the end of each reporting date. In the absence of retained earnings, adjustments to redemption value were recorded against additional paid-in capital, if any, and then to accumulated deficit. As of March 31, 2021, adjustments to the carrying amount of the Convertible Preferred Stock of $1.1 billion, reflecting the estimated redemption value of $7.18 per share as of March 31, 2021, were treated as deemed dividends and were recognized against additional paid-in capital and accumulated deficit on the consolidated balance sheet.

On the Closing Date of the Business Combination, all outstanding Convertible Preferred Stock converted into Class A common stock of the Company, therefore, the Company applied conversion accounting to derecognize the existing carrying amount of the Convertible Preferred Stock and increased additional paid-in capital.

Note 13 — Stockholders' Equity

Common and Preferred Stock

As of March 31, 2022, the Company had authorized a total of 466,000,000 shares of stock, consisting of (i) 400,000,000 shares of Class A common stock, par value $0.0001 per share ("Class A common stock"), (ii) 65,000,000 shares of Class B common stock, par value $0.0001 per share ("Class B common stock"), and (iii) 1,000,000 shares of preferred stock, par value $0.0001 per share ("Preferred Stock"). As of March 31, 2022, the Company had 208,610,490 and 55,539,188 shares of Class A and Class B common stock issued and outstanding, respectively. There were no shares of preferred stock outstanding as of March 31, 2022.

Holders of the Class A and Class B common stock have identical distribution rights, except that holders of the Class A common stock are entitled to one vote per share and holders of the Class B common stock are entitled to ten votes per share. Each share of Class B common stock can be converted into one share of Class A common stock at any time at the option of the stockholder and automatically convert upon sale or transfer, except for certain transfers specified in the Company's amended and restated certificate of incorporation.

In connection with the Business Combination, the Company's executive officers and founders, Chris Kemp and Adam London, converted an aggregate 10,870,562 shares of Founders Preferred Stock and an aggregate 3,599,647 shares of Class A common stock of pre-combination Astra, which were entitled to one vote per share, into 9,622,689 shares of Class B common stock of the Company, which are entitled to ten votes per share.

Founders Convertible Preferred Stock

The Company issued 18,500,000 shares of pre-combination Astra's Founders Convertible Preferred Stock in 2016. Upon vesting, the compensation expense associated with the Founders Convertible Preferred Stock was recorded as stock-based compensation based on the fair value of the Founders Convertible Preferred Stock on the grant date fair value. Immediately before the closing of the Business Combination, 10,870,562 shares of pre-combination Astra's Founders Convertible Preferred Stock were outstanding. Upon closing of the Business Combination, the shares of Founders Convertible Preferred Stock were converted into shares of Class B common stock of the Company, which are entitled to ten votes per share. Refer to Note 3 – Acquisitions.

Note 14 — Stock-based Compensation

Stock-based incentive awards are provided to employees under the terms of various Astra equity incentive plans.

2021 Omnibus Incentive Plan

In June 2021, the Board of Directors approved the 2021 Omnibus Incentive Plan (the "2021 Plan"), which reserved 36.8 million shares of Class A common stock for issuance for awards in accordance with the terms of the 2021 Plan. On January 1, 2022, pursuant to the terms of the 2021 Plan, the number of shares of Class A common stock available for issuance under the 2021 Plan increased by 13.1 million. Similarly, the share reserve increases on January 1 of each year from 2023 to 2031 by the lesser of (i) 5% of the sum of number of shares of (x) Class A common stock and (y) Class B common stock outstanding as of the close of business on the immediately preceding December 31 and (ii) the number of shares of Class A common stock as determined by the Board. The purpose of the 2021 Plan is to advance the Company's interests by providing for the grant to employees, directors, consultants and advisors of stock and stock-based awards. As of March 31, 2022, 17.5 million shares remain available for issuance under the plan.

2021 Employee Stock Purchase Plan

In June 2021, the Board of Directors approved the 2021 Employee Stock Purchase Plan (the "2021 ESPP") to reserve 5 million shares of Class A common stock for issuance for awards in accordance with the terms of the ESPP. On January 1, 2022, pursuant to the terms of the 2021 ESPP, the number of shares of Class A common stock available for issuance under the 2021 ESPP increased by 2.6 million. Similarly, the number of shares of Class A common stock reserved for issuance under the 2021 ESPP will ultimately increase on January 1 of each year from 2023 to 2031 by the lesser of (i) 1% of the sum of number of shares of Class A common stock and Class B common stock outstanding as of the close of business on the immediately preceding December 31 and (ii) the number of shares of Class A common stock as determined by the Board. The purpose of the 2021 ESPP is to enable eligible employees to use payroll deductions to purchase shares of Class A common stock and thereby acquire an interest in the company. Eligible employees are offered shares through a 24-month offering period, which consists of four consecutive 6-month purchase periods. Employees may purchase a limited amount of shares of our stock at a discount of up to 15% of the lesser of the fair market value at the beginning of the offering period or the end of each 6-month purchase period. 151,644 shares were issued under the Employee Stock Purchase Plan during the three months ended March 31, 2022. As of March 31, 2022, 7.5 million shares remain available for issuance under the 2021 ESPP. As of March 31, 2022, the Company had $1.7 million of unrecognized stock-based compensation expense related to the 2021 ESPP. This cost is expected to be recognized over a weighted-average period of 1.24 years.

2016 Equity Incentive Plan

In 2016, pre-combination Astra adopted the 2016 Equity Incentive Plan (the "2016 Plan"). Under this Plan, the Board of Directors or a committee appointed by the Board of Directors is authorized to provide stock-based compensation in the form of stock options, stock appreciation rights, restricted stock, and other performance or value-based awards within parameters set forth in the Plan to employees, directors, and non-employee consultants.

In connection with the Business Combination, the Company assumed the 2016 Plan upon closing. Each outstanding and unexercised option ("Astra Option") was converted, at the exchange ratio established in the BCA, into an option ("New Astra Option") to acquire shares of the Company's Class A common stock with the same terms and conditions as applicable to the Astra Option immediately prior to the Business Combination. As of March 31, 2022, there were no shares available for issuance under the plan.

The following table summarizes stock-based compensation expense that the Company recorded in the condensed consolidated statements of operations for the three months ended March 31, 2022 and 2021:

in thousands	For The Three Months Ended March 31, 2022	2021
Cost of revenues	$ 241	$ —
Research and development	6,736	3,179
Sales and marketing	1,580	13
General and administrative	8,484	7,141
Stock-based compensation expense	$ 17,041	$ 10,333

On November 22, 2021, under the 2021 Plan, the Company's compensation committee issued 1,047,115 PSUs to the employees of Apollo who joined Astra. PSUs are subject to certain performance-based and service-based vesting conditions and would vest over four years with 25% of awards vesting on July 1, 2022, and the remaining 75% vesting quarterly over the remaining 12 quarters beginning on November 15, 2022, only for the portion of PSUs that is eligible to become vested which will be determined based upon timely satisfaction of performance conditions. The number of PSUs vested will be determined by multiplying the total number of PSUs granted by the percentage of milestones achieved and by the percentage of PSUs that satisfy the time-based vesting condition on such time-vesting date.

Certain performance conditions for PSUs are subjective and the number of PSUs related to these performance conditions do not meet the criteria for the grant date. Accordingly, 523,557 PSUs and 52,355 PSUs related to the performance conditions that are not subjective are considered granted as of November 22, 2021 and January 21, 2022, respectively. The remaining PSUs issued did not meet the grant date criteria as of March 31, 2022. The Company will re-assess at the end of each reporting period if any further PSUs has met the grant date criteria and account for it in the period in which it meets the grant date criteria.

As of March 31, 2022, the Company assessed the probability of success for the performance conditions that are not subjective and determined that the Company has achieved certain of these performance conditions within the requisite period. Therefore, the Company recognized $1.0 million compensation costs related to PSUs for the three months ended March 31, 2022.

On September 20, 2021, under the 2021 Plan, the Company's compensation committee granted 3,972,185 restricted stock units ("RSUs"), 3,426,094 time-based stock options and 13,016,178 performance stock options ("PSOs") to its executive officers. RSUs and time-based stock options granted have service-based vesting conditions only. The service conditions vary for each executive officer and is based on their continued service to the Company. Option holders have a 10-year period to exercise their options before options expire. Forfeitures are recognized in the period of occurrence and stock-based compensation costs are recognized based on grant-date fair value as RSUs and time-based stock options vest.

PSOs, only eligible to the executive officers of the Company, are subject to performance conditions as follows, and the milestones do not need to be achieved in any specific order or sequence:

Milestone A: The Company has had a successful orbital delivery.

Milestone B: The Company has had six orbital launches during a six consecutive month period.

Milestone C: The Company has completed a prototype for a spacecraft that has achieved an orbital launch.

Milestone D: The Company has conducted twenty-six orbital launches during a six consecutive month period.

Milestone E: The Company has achieved an orbital launch for an aggregate of 100 spacecraft.

These PSOs also require the volume weighted average share price for a period of thirty trading days meet share price thresholds of $15.00, $20.00, $30.00, $40.00 and $50.00 following the achievement of the first milestone, second milestone, third milestone, fourth milestone and fifth milestone, respectively, before a milestone will be deemed achieved. After each milestone is achieved, 20% of the PSOs will vest on the vesting date immediately following the date at which the price thresholds are met. For this purpose, a "vesting date" is February 15, May 15, August 15 and November 15 of any applicable year. The milestones must be achieved over a period of approximately five years, with the earliest vesting date of November 15, 2022, and the last vesting date no later than November 15, 2026, if all vesting conditions are met. No unvested portion of the PSOs shall vest after November 15, 2026. As of March 31, 2022, the Company assessed the probability of success for the five milestones mentioned above and determined that it is probable that the Company will achieve Milestone A and Milestone B within the requisite period. Therefore, the Company recognized $4.9 million compensation costs related to PSOs for the three months ended March 31, 2022. As of March 31, 2022, we had unrecognized stock-based compensation expense of $32.8 million for the milestones that were not considered probable of achievement.

In February 2021, the Board of Directors approved the acceleration in vesting of 206,250 pre-combination Astra stock options that were issued to one employee on May 15, 2020. The remaining unvested options were fully vested upon acceleration. The Company recorded a $1.4 million stock-based compensation expense related to the modification for the three months ended March 31, 2021.

As of March 31, 2022, the Company had $130.9 million of unrecognized stock-based compensation expense related to all of the Company's stock-based awards. This cost is expected to be recognized over a weighted-average period of 2.94 years.

Secondary Sales

In January 2021, concurrent with Series C Financing, two executive officers, Chris Kemp, founder and Chief Executive Officer ("CEO"), and Adam London, founder and Chief Technology Officer ("CTO"), entered into stock purchase agreements with certain investors including ACME SPV AS, LLC to sell 3,775,879 and 2,265,529 shares, respectively, of Founders Convertible Preferred Stock at purchase prices in excess of the estimated fair value at the time of the transactions ("January 2021 Secondary Sales") to certain investors. Upon the sale, the Founders Convertible Preferred Stock automatically converted into Series C Convertible Preferred Stock. The Company's board member, Scott Stanford, is a member of ACME SPV AS, LLC and the Company facilitated the January 2021 Secondary Sales. As a result, for the three months ended March 31, 2021, the Company recorded a total of $8.2 million in stock-based compensation expense for the difference between the price paid by these investors and the estimated fair value of the Founders Convertible Preferred Stock on the date of the transaction.

Stock Options Awards

The following is a summary of stock option activity for the three months ended March 31, 2022:

	No. of Options	Weighted-Average Exercise Price	Weighted-Average Remaining Term (in Years)	Aggregate Intrinsic Value
Outstanding – December 31, 2021	20,326,384	$ 7.52	9.4	$22,782,654
Granted	1,142,027	5.21	9.8	
Exercised	(176,774)	0.45	4.4	783,216
Forfeited	(24,661)	2.93	—	
Expired	(1,465)	6.75	—	
Outstanding – March 31, 2022	21,265,511	$ 7.46	9.2	$11,290,701
Unvested – March 31, 2022	18,932,836	8.11	9.3	5,150,439
Exercisable – March 31, 2022	2,332,675	2.12	7.9	6,140,262

The company uses the Black-Scholes option pricing-model to calculate the grant date fair value of time-based options. The following table summarizes the assumptions used in estimating the fair value of options granted in the three months ended March 31, 2022:

	Time Based Stock Options
Expected terms (years)[1]	5.81
Expected volatility[2]	68.9%
Risk-free interest rate[3]	1.70%
Expected dividend rate[4]	—
Grant-date fair value	$ 3.20

(1) The expected term is the length of time the grant is expected to be outstanding before it is exercised or terminated. This number is calculated as the midpoint between the vesting term and the original contractual term (contractual period to exercise). If the option contains graded vesting, then the vesting term would be based on the vesting pattern.
(2) Expected volatility, or the standard deviation of annualized returns, was calculated based on comparable companies' reported volatilities.
(3) Risk-free interest was obtained from US treasury notes for the expected terms noted as of the valuation date.
(4) The Company has assumed a dividend yield of zero as it has no plans to declare dividends in the foreseeable future.

Restricted Stock Units Awards

The following is a summary of restricted stock units for the three months ended March 31, 2022:

	Number of RSUs Outstanding	Weighted-Average Grant Date Fair Value Per Share
Outstanding – December 31, 2021	10,678,818	$ 9.20
Granted	3,937,226	4.25
Vested	(828,680)	8.64
Forfeited	(328,562)	9.23
Outstanding – March 31, 2022	13,458,802	$ 7.78

Total fair value as of the respective vesting dates of restricted stock units vested for the three months ended March 31, 2022 was approximately $2.9 million. As of March 31, 2022, the aggregate intrinsic value of unvested restricted stock units was $51.9 million.

Note 15 — Loss per Share

Founders Convertible Preferred Stock and Convertible Preferred Stock were participating securities in periods of income, as the Founders Convertible Preferred Stock and Convertible Preferred Stock participated in undistributed earnings on an as-if-converted or as-vested basis. However, the Founders Convertible Preferred Stock and Convertible Preferred Stock, did not share in losses.

The Company computes earnings per share of Common Stock using the two-class method required for participating securities and does not apply the two-class method in periods of net loss. Basic and diluted earnings per share were the same for the periods presented as the inclusion of all potential Common Stock outstanding would have been anti-dilutive. Earnings per share calculations for all periods prior to the Business Combination have been retrospectively restated to the equivalent number of shares reflecting the exchange ratio established in the BCA. Subsequent to the Business Combination, earnings per share was calculated based on weighted average number of shares of common stock then outstanding.

The following tables set forth the computation of basic and diluted loss for the three months ended March 31, 2022 and 2021:

	For The Three Months Ended March 31,			
	2022		2021	
(in thousands, except share and per share amounts)	Class A Common	Class B Common	Class A Common	Class B Common
Net loss attributed to common stockholders	$ (67,657)	$ (18,056)	$ (40,862)	$ (118,110)
Adjustment to redemption value on Convertible Preferred Stock	—	—	(260,051)	(751,675)
Net loss attributed to common stockholders	$ (67,657)	$ (18,056)	$ (300,913)	$ (869,785)
Basic weighted average common shares outstanding	208,112,630	55,539,188	16,206,813	46,845,555
Dilutive weighted average common shares outstanding	208,112,630	55,539,188	16,206,813	46,845,555
Loss per share attributable to common stockholders:				
Basic and Diluted loss per share	$ (0.33)	$ (0.33)	$ (18.57)	$ (18.57)

There were no preferred dividends declared or accumulated as of March 31, 2021. The following securities were not included in the computation of diluted shares outstanding because the effect would be anti-dilutive:

	As of March 31,			
	2022		2021	
	Class A Common	Class B Common	Class A Common	Class B Common
Stock options	8,249,326	—	7,553,987	—
RSUs	13,359,326	—	—	—
Convertible Preferred Stock	—	—	131,568,927	—
Warrants	—	—	480,520	—
Total	21,608,652	—	139,603,433	—

Note 16 — Related Party Transactions

Cue Health, Inc.

The Company began purchasing COVID-19 test readers and related test cartridges from Cue Health Inc. in the late second quarter 2021, at its standard pricing. In August 2021, the Company entered into a six-month subscription arrangement with Cue Health Inc. for the purchase of COVID-19 test readers and the related test cartridges. Under Cue Health Inc.'s standard subscription arrangement, the Company receives a twenty percent (20%) discount on each Cue Reader and fourteen percent (14%) discount on each test cartridge. Mr. Stanford, a member of the Board and the Company's Lead Director, serves on the board of directors of Cue Health Inc. Funds affiliated with ACME Capital collectively beneficially own 10.4% of the outstanding common stock of Cue Health Inc. Mr. Stanford was not involved in the negotiation of the Company's arrangement with Cue Health Inc. The Company conducted its independent evaluation of Cue's services and determined in its sole judgment Cue's product and services were the best option for the Company to ensure it could maintain a safe and productive work environment. The Company made purchases of $0.4 million during the three months ended March 31, 2022. No such purchases were made during the three months ended March 31, 2021.

Convertible Promissory Notes

In June 2019, the Company issued promissory convertible notes to A/NPC Holdings LLC and Sherpa Ventures Fund, II LP for gross proceeds of $10.0 million and $0.6 million, respectively. In November 2020, the Company issued promissory convertible notes to Sherpa Ventures Fund II, LP and Eagle Creek Capital LLC, for gross proceeds of $0.2 million and $0.5 million, respectively. Some of the Company's board members at that time were or are related parties of these entities. Nomi Bergman, who was serving as our director when the promissory convertible notes were issued, is a principal of A/NPC Holdings LLC and Scott Stanford, who serves as our director, is a principal of Sherpa Ventures Fund II, LP and a member of Eagle Creek Capital, LLC. In all instances the terms of these transactions were the same as third-party investors.

On January 28, 2021, the Company settled the promissory convertible notes through the issuance of Series C convertible preferred stock. 7,819,887 and 469,193 shares of Series C convertible preferred stock were issued to A/NPC Holdings LLC and Sherpa Ventures Fund II, LP at a per share price of $1.33 to settle $10.4 million and $0.6 million outstanding principal and accrued interest, respectively. Additionally, 264,928 and 115,771 shares of Series C convertible preferred stock were issued to Eagle Creek Capital, LLC and Sherpa Ventures Fund II, LP at a per share price of $1.71 to settle $0.5 million and $0.2 million outstanding principal and accrued interest, respectively. See Note 6 — Long-Term Debt for mechanism of settlement.

Note 17 — Subsequent Events

On April 27, 2022, a stockholder derivative suit was filed in the United States District Court for the Eastern District of New York styled Gonzalez v. Kemp, et al., Case No. 22-cv-02401 (E.D.N.Y.). The complaint asserts claims against the current members of the Company's board of directors and certain of its current and former officers for alleged breaches of their fiduciary duties, unjust enrichment, abuse of control, mismanagement, and waste of corporate assets, alleged violations of Section 14(a) of the Securities Exchange Act of 1934 (the "Exchange Act"), and for contribution under Section 10(b) and 21D of the Exchange Act based upon the conduct alleged in the Artery Action described under Note 11— Commitments and Contingencies. The plaintiff seeks monetary damages in favor of the Company in an unstated amount, reforms to the Company's corporate governance and internal procedures, restitution including disgorgement of any compensation, profits or other benefits received, and reimbursement of the plaintiff's reasonable fees and costs, including attorney's fees. The Company believes that the case is without merit and intends to defend it vigorously. Due to the early stage of the case, neither the likelihood that a loss, if any, will be realized, nor an estimate of the possible loss or range of loss, if any, can be determined.

Item 2. Management's Discussion and Analysis of Financial Condition and Results of Operations.

The following discussion and analysis of the financial condition and results of operations of Astra Space, Inc. should be read together with our audited consolidated financial statements as of and for the years ended December 31, 2021 and 2020 and unaudited interim condensed consolidated financial statements as of and for the three months ended March 31, 2022 and 2021, together with related notes thereto. This discussion may contain forward-looking statements based upon current expectations that involve risks and uncertainties. Our actual results may differ materially from those projected in these forward-looking statements as a result of various factors, including those set forth in the risk factors previously disclosed in our annual report on Form 10-K for the year ended December 31, 2021, and filed with the SEC on March 31, 2022. Certain amounts may not foot due to rounding. Unless the context otherwise requires, all references in this section to "the Company" "Astra," "us," "our" or "we" refer to Astra Space, Inc. after the closing of the Business Combination on June 30, 2021, and Astra Space Operations, Inc, formerly known as Astra Space, Inc, prior to the Business Combination.

Overview

Our mission is to launch a new generation of launch services and space services and products to Improve Life on Earth from Space™. These services and products are enabled by new constellations of small satellites in Low Earth Orbit ("LEO"), which have rapidly become smaller, cheaper, and many times more numerous than legacy satellites. Launch vehicles, however, have not evolved in the same way — most rockets remain focused on serving legacy satellites and human spaceflight missions and we aim to provide the world's first mass-produced orbital launch system. While our primary focus remains the growth and development of our launch services offerings, we continue to develop other product and service offerings to support our overall mission to improve life on Earth from space and are also focus on the acquisition, license or development of core space technology to support the growth and development of our product and service offerings. For example, on June 2, 2021, we announced the acquisition of Apollo Fusion, Inc. and acquired its ACE propulsion system and, on November 4, 2021, we announced the filing of an application with the Federal Communications Commission for V-band spectrum assets to support a future constellation to further enable communications and connectivity.

COVID-19 Impact

On March 11, 2020, the World Health Organization declared the novel strain of coronavirus ("COVID-19") a global pandemic and recommended containment and mitigation measures worldwide. The extent of the impact of the coronavirus pandemic on Astra's operational and financial performance will depend on various future developments, including variants of the disease, the duration and spread of the outbreak and impact on its customers, suppliers, and employees, all of which is uncertain at this time. Astra believes the COVID-19 pandemic may adversely impact future revenue and results of operations, but Astra is unable to predict at this time the size and duration of this adverse impact. Astra has seen some signs of positive effects for its long-term business prospects and partnerships as a result of the pandemic. The COVID-19 pandemic has created an even greater need for broadband internet access, and businesses are thinking differently about how their workforce can stay connected. There have also been recent government and commercial announcements about continuous investments in this area and we believe this will continue to support the growth of the small satellite market for the foreseeable future.

Key Factors Affecting Our Results and Prospects

We believe that our performance and future success depend on a number of factors that present significant opportunities for us but also pose risks and challenges, including competition from better known and well-capitalized companies, the risk of actual or perceived safety issues and their consequences for our reputation and the other factors discussed under "Risk Factors" in our Annual Report on Form 10-K for the period ended December 31, 2021, filed with the SEC on March 31, 2022. We believe the factors discussed below are key to our success.

Commencing and Expanding Commercial Launch Operations

We commenced paid commercial launch services in 2022, with our launch on February 10, 2022, of launch vehicle LV0008. After a nominal first stage flight, the payload fairing did not fully deploy prior to the upper stage ignition due to an electrical issue which, together with a software issue, resulted in the upper stage not reaching orbit and the end of the mission. Through our investigation process, we identified and have since corrected the issues that caused the error in the payload fairing's deployment and addressed the software issue. On March 15, 2022, we conducted an orbital launch for three customers of Spaceflight, Inc. and confirmed our first delivery of customer payloads into Earth orbit. To conduct our launches, we are required to receive commercial space transportation licenses from the FAA. Any delays in commencing our commercial launch operations, including due to delays or cost overruns in obtaining FAA licenses or other regulatory approvals for future versions of our launch vehicles or at future spaceports, could adversely impact our results and growth plans.

We are on track to achieve a monthly launch capability by accelerating production of our launch vehicles by the end of 2022, with a goal of reaching an even more frequent launch capability in the future. When we refer to a "commercial launch," we mean a launch conducted under an FAA commercial launch license.

Lowering Manufacturing Costs and Increasing Payloads

We aim to be a cost-efficient dedicated orbital launch system provider. We plan to increase the maximum payload capacity of our launch vehicle to meet customer needs and demands through a process of iterative development and improvement. We have made significant investment in our manufacturing facility through March 31, 2022, and we expect this facility will be at full capacity by the end of 2024. Please see risk factors previously disclosed in our Annual Report on Form 10-K for the period ended December 31, 2021, filed with the SEC on March 31, 2022, for factors that could affect our ability to realize benefits from the investment in our manufacturing facility. While we believe that our estimate is reliable, the development and build-out of our manufacturing facility may take longer than planned, including due to delays in obtaining federal and state regulatory approvals of our final construction plans or any changes that are required to be made to those plans. Any delays in our achieving full manufacturing capacity could adversely impact our results and growth plans.

Leveraging Core Technologies

We plan to develop, license or acquire core space technologies that we expect to commercialize and incorporate into our launch vehicles, spacecrafts and other infrastructure that we will use to deliver our product and space service offerings. These core technologies including, among other things, electric propulsion and solar power. For example, we acquired propulsion technology through our merger with Apollo Fusion, which we announced on June 2, 2021, and closed on July 1, 2021.

Expand Our Space Services Offerings

We are in the preliminary stages of developing our space services offering, providing modular configurable satellite buses for customers, leveraging both in-house and partner-provided subsystem components and in-house design and integration services, as well as operational support of satellites on orbit, to turn-key provision of entire constellations, offering "concept to constellation" in months instead of years. Specifically, our space services encompass all aspects of hosted satellite and constellation services, including hosting customer payloads onto our satellites, and delivering services, such as communication services. These services are expected to allow customers to focus on developing innovative payloads rather than having to design or develop complete satellite buses or satellites or constellations, which we will provide, along with ancillary services that are likely to include telemetry, tracking and control ("TT&C"), communications, processing, as well as software development and maintenance.

On November 4, 2021, we filed an application with the FCC, under which we requested authority to launch and operate a non-geostationary orbit satellite system using V-band frequencies (the "Constellation") as we work to build out our space services offering to enable communications.

We expect to make significant investments in our space services programs. Although we believe that our financial resources will be sufficient to meet our capital needs for at least 12 months from the date of this Quarterly Report on Form 10-Q, our timeline and budgeted costs for these offerings are subject to substantial uncertainty, including due to compliance requirements of U.S. federal export control laws and applicable foreign and local regulations, the impact of political and economic conditions, and, particularly in the case of our anticipated Spaceport offering, the need to identify opportunities and negotiate long-term agreements with customers for these services, among other factors.

Key Components of Results of Operations

We are an early-stage company and our historical results may not be indicative of our future results for reasons that may be difficult to anticipate. Accordingly, the drivers of our future financial results, as well as the components of such results, may not be comparable to our historical or future results of operations.

Revenues

We commenced our first paid commercial launch, which occurred in February 2022, followed by a second paid commercial launch which occurred in March 2022. These launches represent the start of our paid commercial launch operations. We expect to generate a significant portion of our revenues in launch services from delivering customers' payloads into orbit. We also expect to generate revenues by delivering space products and space services to our customers in the future. Over time, we expect space services to grow more quickly and to represent a significant portion of our revenues after 2025.

Cost of Revenues

Cost of revenues consist primarily of direct material, direct labor, manufacturing overhead, other personnel-related expenses, which include salaries, bonuses, benefits and stock-based compensation expense and depreciation expense. Cost of revenues also includes charges to write-down the carrying value of inventory when it exceeds its estimated net realizable value. We anticipate recording write-downs to our inventory over the foreseeable future as we continue to ramp production of our launch vehicles. We expect our cost of revenues to increase in absolute dollars in future periods as we sell more launch services and space products. As we grow into our current capacity and execute on cost-reduction initiatives, we expect our cost of revenues as a percentage of revenue to decrease over time.

Operating Expenses

Research and Development Expense

Our research and development expenses consist primarily of internal and external expenses incurred in connection with our research activities and development programs. These expenses include, but are not limited to, development supplies, testing materials, personnel and personnel-related costs (including salaries, bonuses, benefits, and stock-based compensation expense), depreciation expense, amortization of intangible assets, overhead allocation (consisting of various support and facility costs) and consulting fees. Research and development costs are expensed as incurred.

We allocate research and development costs by function rather than by project, as a significant majority of our historical research and development spending was related to the initial development and testing of our underlying technology, including preparation for multiple test launches.

Our current primary research and development objectives focus on the development and finalization of our offerings. The successful development of these offerings involves many uncertainties, including:

- timing in finalizing launch and space systems design and specifications;
- successful completion of analyses and ground test programs to validate that new or changed designs perform as expected;
- successful completion of flight test programs, including flight safety tests;
- our ability to obtain additional applicable approvals, licenses or certifications from regulatory agencies, if required, and maintaining current approvals, licenses or certifications;
- performance of our manufacturing facilities despite risks that disrupt productions, such as natural disasters and hazardous materials;
- performance of a limited number of suppliers for certain raw materials and components;
- performance of our third-party contractors that support our research and development activities;
- our ability to maintain rights from third parties for intellectual properties critical to research and development activities; and
- our ability to continue funding and maintain our current research and development activities.

A change in the outcome of any of these variables could delay the development of our launch and space systems, which in turn could impact the timing of commercialization of our offerings.

As we are developing and building our launch services, we have expensed all research and development costs associated with developing and building our launch services offering. We expect that our research and development expenses will increase in the short-term as we invest in improving and further reducing the costs of our launch system as well as developing and improving our space services offering.

Sales and Marketing Expense

Sales and marketing expenses consist of personnel and personnel-related expenses (including stock-based compensation) for our business development team as well as advertising and marketing expenses. We expect to increase our sales and marketing activities in order to grow our customer base and increase market share. We also expect that our sales and marketing expenses will increase over time as we continue to hire additional personnel to scale the business.

General and Administrative Expense

General and administrative expenses consist primarily of personnel and personnel-related costs (including salaries, bonuses, benefits, and stock-based compensation expense) for personnel in executive, finance, accounting, corporate development and other administrative functions. General and administrative expenses also include legal fees, professional fees paid for accounting, auditing, consulting, tax, and investor relations services, insurance costs, and facility costs not otherwise included in research and development expenses and costs associated with compliance with the rules and regulations of the SEC and the stock exchange.

Income Tax (Benefit) Expense

Our income tax provision consists of an estimate for U.S. federal and state income taxes based on enacted rates, as adjusted for allowable credits, deductions, uncertain tax positions, changes in deferred tax assets and liabilities, and changes in the tax law. We maintain a valuation allowance against the full value of our U.S. and state net deferred tax assets because we believe the recoverability of the tax assets is not more likely than not.

Other Income (Expense), Net

Other income (expense), net primarily consists of income from government research and development contracts.

Critical Accounting Estimates

Our financial statements have been prepared in accordance with U.S. generally accepted accounting principles, or U.S. GAAP. Preparation of the financial statements requires our management to make a number of judgments, estimates and assumptions relating to the reported amount of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenue and expenses during the reporting period. We consider an accounting judgment, estimate or assumption to be critical when (1) the estimate or assumption is complex in nature or requires a high degree of judgment and (2) the use of different judgments, estimates and assumptions could have a material impact on our consolidated financial statements. Our significant accounting policies are described in Note 2 in our Annual Report on Form 10-K for the year ended December 31, 2021, as updated as applicable in Note 1 to the condensed consolidated financial statements herein.

There were no significant changes in our critical accounting estimates during the three months ended March 31, 2022 compared to those previously disclosed in “Critical Accounting Estimates” in “Management’s Discussion and Analysis of Financial Condition and Results of Operations” included in the 2021 Annual Report on Form 10-K

Results of Operations

Comparison of the Three Months Ended March 31, 2022 and 2021

(in thousands, except percentages)	For The Three Months Ended March 31, 2022	2021	Period over period change ($)	(%)
Revenues	$ 3,911	$ —	$ 3,911	n.m.
Cost of revenues	11,014	—	11,014	n.m.
Gross loss	(7,103)	—	(7,103)	n.m.
Operating expenses:				
Research and development	37,927	$ 12,196	$ 25,731	211%
Sales and marketing	4,764	64	4,700	7,344
General and administrative	20,986	12,394	8,592	69
Loss on change in fair value of contingent consideration	15,500	—	15,500	n.m.
Total operating expenses	79,177	24,654	54,523	221
Operating loss	(86,280)	(24,654)	(61,626)	250
Interest (expense) income, net	174	(535)	709	(133)
Other income (expense), net	393	—	393	n.m.
Loss on extinguishment of convertible notes	—	(131,908)	131,908	n.m.
Loss on extinguishment of convertible notes attributable to related parties	—	(1,875)	1,875	n.m.
Loss before taxes	(85,713)	(158,972)	73,259	(46)
Income tax (benefit) expense	—	—	—	n.m.
Net loss	$(85,713)	$ (158,972)	73,259	(46)
Adjustment to redemption value on Convertible Preferred Stock	—	(1,011,726)	1,011,726	n.m.
Net loss attributable to common stockholders	$(85,713)	$(1,170,698)	$1,084,985	-93%

n.m. = not meaningful.

Revenues

Revenues were $3.9 million for the three months ended March 31, 2022, all of which were related to launch services as we commenced paid commercial launch services during the period. We launched launch vehicles LV0008 and LV0009 on February 10, 2022 and March 15, 2022, respectively, both of which were paid launches. The orbital launch of LV0009 conducted on March 15, 2022, represents our first paid delivery of customer payloads into Earth orbit. No revenues were recognized for the three months ended March 31, 2021.

Cost of Revenues

Cost of revenues were $11.0 million for the three months ended March 31, 2022. which was primarily driven by recording of $5.5 million of cost of launch services related to our launches of launch vehicles: LV0008 and LV0009 and a $5.5 million of inventory net realizable value write downs. In the first quarter, we conducted our first paid commercial launch and have not yet achieved economies of scale in our manufacturing processes. As a result, we may continue to incur negative gross margins for the remainder of 2022.

Research and Development

Research and development costs were $37.9 million for the three months ended March 31, 2022, compared to $12.2 million for the three months ended March 31, 2021. The $25.7 million increase mainly reflected a $11.9 million increase in personnel-related costs due to headcount increases in research and development departments, a $3.8 million increase in stock-based compensation expense, a $3.8 million increase in research and development materials expense, a $1.8 million increase in third party consulting and recruitment costs, a $1.3 million increase in depreciation and amortization expense and a $0.7 million increase in technology licensed and software subscription licenses related expenses with the remainder due to changes in other research and development expenses. These increases were to support our product roadmap and launch services.

Sales and Marketing

Sales and marketing expenses were $4.8 million for the three months ended March 31, 2022, compared to $0.1 million for the three months ended March 31, 2021. The $4.7 million increase mainly reflected a $1.9 million increase in personnel-related costs, a $1.6 million in stock-based compensation expense, a $0.4 million increase in depreciation expense and a $0.4 million increase in third-party consulting and recruitment costs due to increased headcount in sales and marketing departments with the remainder due to changes in other sales and marketing expenses. These increases were to support business development and marketing activities.

General and Administrative

General and administrative expenses were $21.0 million for the three months ended March 31, 2022, compared to $12.4 million for the three months ended March 31, 2021. The $8.6 million increase was primarily due to a $5.4 million increase in employee costs due to increased headcount, a $2.0 million increase in insurance related expenses, a $1.4 million increase in accounting, audit and legal related fees and a $1.3 million increase in stock-based compensation expense which is partially offset by a decrease in the remainder of general and administrative expense due to changes in facilities costs, IT equipment fees, and software subscription fees.

Loss on Change in Fair Value of Contingent Consideration

Loss on change in fair value of contingent consideration of $15.5 million for the three months ended March 31, 2022 was due to higher revenues forecasted in estimating the fair value of contingent consideration. No loss on change in fair value of contingent consideration was recorded for the three months ended March 31, 2021.

Interest (Expense) Income, Net

Interest income was $0.2 million for the three months ended March 31, 2022, compared to interest expense of $0.5 million for the three months ended March 31, 2021. The $0.7 million increase in interest expense (income), net was primarily due to the settlement of outstanding debt during the year ended December 31, 2021. Therefore, we did not incur any interest expense during the period and an increase of $0.2 million in interest income related to investment in marketable securities during the three months ended March 31, 2022.

Other Income (expense), Net

Other income (expense), net of $0.4 million related to income from government research and development contracts for the three months ended March 31, 2022. There was no such other income (expense) for the three months ended March 31, 2021.

Loss on Extinguishment of Convertible Notes

No loss on extinguishment of convertible notes was recorded for the three months ended March 31, 2022. Loss on extinguishment of convertible notes of $131.9 million for the three months ended March 31, 2021 was due to the settlement of convertible notes on January 28, 2021.

Loss on Extinguishment of Convertible Notes Attributable to Related Parties

No loss on extinguishment of convertible notes attributable to related parties was recorded for the three months ended March 31, 2022. Loss on extinguishment of convertible notes attributable to related parties of $1.9 million for the three months ended March 31, 2021 was due to the settlement of convertible notes attributable to related parties on January 28, 2021.

Adjustment to redemption value on Convertible Preferred Stock

No adjustment to redemption value on convertible preferred stock was recorded for the three months ended March 31, 2022. Adjustment to redemption value on Convertible Preferred Stock of $1,011.7 million for the three months ended March 31, 2021, was due to the re-measurement of Convertible Preferred Stock to its redemption value due to the likelihood of a redemption event becoming probable.

Liquidity and Capital Resources

Liquidity

The following section discusses our principal liquidity and capital resources as well as our primary liquidity requirements and uses of cash. Our cash and cash equivalents are maintained in highly liquid investments with remaining maturities of 90 days or less at the time of purchase. We believe our cash equivalents are liquid and accessible.

We measure liquidity in terms of our ability to fund the cash requirements of our research and development activities and our current business operations, including our capital expenditure needs, contractual obligations and other commitments. Our current liquidity needs relate to business operations, research and development activities, mainly in connection with the ongoing development of our technology, lease obligations and capital expenditures, which primarily relate to the development of our manufacturing facility.

The condensed consolidated financial statements included elsewhere in this Quarterly Report on Form 10-Q have been prepared on a going concern basis. We have historically funded our operations primarily by equity financings and convertible promissory notes prior to the Business Combination and subsequently funded its operations through cash proceeds obtained as part of the Business Combination and related private placement. As of March 31, 2022, our existing sources of liquidity included cash and cash equivalents of $161.5 million and marketable securities of $93.7 million. We have a limited history of operations and have incurred negative cash flows from operating activities and loss from operations in the past as reflected in the accumulated deficit of $1,494.1 million as of March 31, 2022. We expect to continue to incur operating losses due to the investments it intends to make in its business, including the development of our products and services. Management continuously evaluates opportunities to strengthen our financial position, including through the issuance of additional equity securities or by entering into new financing arrangements, as appropriate, and we will need to raise additional capital to achieve our space services goals. However, we have adequate liquidity that we expect will be sufficient to fund operating and capital expenditure requirements through at least 12 months from the date of filing this Quarterly Report on Form 10-Q. The Company's current liquidity may not be sufficient to meet the required long-term liquidity needs associated with continued use of cash from operating activities at historical levels, in addition to its other liquidity needs associated with its capital expenditures, and other investing requirements. For additional information regarding our cash requirements from contractual obligations and lease obligations, see Note 11 — Commitments and Contingencies and Note 9 — Leases in Part I, Item 1 of this Quarterly Report on Form 10-Q.

Summary Statement of Cash Flows for the Three Months Ended March 31, 2022 and 2021

The following table sets forth the primary sources and uses of cash and cash equivalents for the periods presented below:

	For The Three Months Ended March 31,		Period over period change	
(in thousands)	2022	2021	$	%
Net cash used in operating activities	$ (48,274)	$(13,677)	$ (34,597)	253%
Net cash used in investing activities	(115,683)	(3,524)	(112,159)	3,183
Net cash provided by financing activities	471	29,138	(28,667)	(98)
Net increase (decrease) in cash and cash equivalents and restricted cash	$(163,486)	$ 11,937	$(175,423)	(1470)%

Cash Flows used in Operating Activities

Our cash flows from operating activities are significantly affected by our cash investments to support the growth of our business in areas such as research and development and general and administrative and working capital. Our operating cash inflows include cash from milestone billing under certain launch services contracts. These cash inflows are offset by our payments to suppliers for production materials and parts used in our manufacturing process as we ramp up our production, payments to our employees and other operating expenses.

For the three months ended March 31, 2022, net cash used in operating activities was $48.3 million. The primary factors affecting the Company's operating cash flows during the period were a net loss of $85.7 million. This is offset by non-cash charges including stock-based compensation expense of $17.0 million, loss on change in fair value of contingent consideration of $15.5 million, inventory net realizable value write-downs of $5.5 million, depreciation and amortization expense of $2.8 million, non-cash lease expense of $0.4 million and accretion of marketable securities purchased at premium of $0.1 million. Changes in operating working capital items is mainly due to increased headcount and ramp-up of our production and primarily reflect the increase in inventories of $6.5 million, accounts payable of $0.1 million and other non-current liabilities of $0.5 million. Changes in operating working capital items was partially offset by a decrease in trade accounts receivable of $1.4 million, prepaid and other current assets of $1.0 million, Other non-current assets of $0.1 million, lease liabilities of $0.3 million and accrued expenses and other current liabilities of $0.1 million.

For the three months ended March 31, 2021, net cash used in operating activities was $13.7 million, which was comprised of net loss of $159.0 million, offset by non-cash charges including non-cash loss on extinguishment of convertible notes of $133.8 million, stock-based compensation expense of $10.3 million, depreciation expense of $0.9 million, amortization of convertible note debt discounts of $0.4 million and non-cash lease expense of $0.2 million. Changes in operating working capital items primarily reflect the increase in inventories of $0.4 million, prepaid and other current assets of $4.2 million, accounts payable of $0.7 million, lease liabilities of $0.1 million, accrued expenses and other current liabilities of $3.3 million and other non-current liabilities of $0.2 million.

Cash Flows used in Investing Activities

For the three months ended March 31, 2022, net cash used in investing activities was $115.7 million, which was comprised mainly of purchases of marketable securities of $93.9 million, purchases of property, plant and equipment of $20.9 million mainly related to the construction of our manufacturing facility and acquisition of an indefinite-lived intangible trademark asset of $0.9 million.

For the three months ended March 31, 2021, net cash used in investing activities was $3.5 million, which was comprised of acquisition of an indefinite-lived intangible trademark asset of $3.2 million and purchases of property, plant and equipment of $0.3 million.

Cash Flows from Financing Activities

For the three months ended March 31, 2022, net cash provided by financing activities amounted to $0.5 million and consisted primarily of proceeds from employee stock purchase plan of $0.4 million and issuance of stock under equity plans of $0.1 million.

For the three months ended March 31, 2021, net cash provided by financing activities amounted to $29.1 million and consisted primarily of issuance of Series C of $29.1 million and issuance of stock under equity plans of $0.2 million, offset by repayments on borrowings of $1.0 million.

Commitments and Contractual Obligations

We are a party to operating leases primarily for land and buildings (e.g., office buildings, manufacturing and testing facilities and spaceport) and certain equipment (e.g., copiers) under non-cancellable operating leases. The following table summarizes our lease commitments as of March 31, 2022:

Year Ended December 31	Minimum Lease Commitment (in thousands)
2022 (remainder)	$ 1,412
2023	1,790
2024	1,677
2025	1,655
2026	1,642
Thereafter	2,840
Total future undiscounted minimum lease payments	$ 11,016
Less: Imputed Interest	2,187
Total reported lease liability	$ 8,829

On May 25, 2021, the Company entered a contract with a supplier to purchase components. The Company is obligated to purchase $22.5 million of components over 60 months. The Company may terminate the supply agreement by paying 50% of the remaining purchase commitment at any point during the contract term. The Company made total purchases of $0.8 million under the contract of which $0.4 million related to purchases made during the three months ended March 31, 2022. We also made advance payments of $0.4 million under the contract during the three months ended March 31, 2022.

Apart from the aforementioned leases and purchase commitments, we do not have any other material contractual obligations, commitments or contingent obligations.

Compliance With Continued Listing Standards of NASDAQ Global Select Market ("Nasdaq")

In conjunction with preparing our annual report on Form 10-K for the year ended December 31, 2021, we became aware that at the end of 2021 our filer status changed from non-accelerated filer to large-accelerated filer. As a result of this change in status, our annual report on Form 10-K was filed late. Under the Nasdaq listing standards, we are required to file our reports timely with the Securities and Exchange Commission. When we discovered the change in our filing status, we promptly notified Nasdaq.

Item 3. Quantitative and Qualitative Disclosures About Market Risk

We have not, to date, been exposed to material market risks given our early stage of operations. As we expand our commercial operations, we expect to be exposed to foreign currency exchange rate and commodity price risks, particularly related to rocket propellants, helium, and aluminum, among others, and potentially other market risks, including those related to interest rates or valuation of financial instruments, among others.

Interest Rate Risk

As of March 31, 2022, we had $6.1 million of cash equivalents invested in money market funds and $93.7 million invested in marketable securities, which consisted of U.S. Treasury securities, corporate debt securities, commercial paper and asset backed securities. Our cash and cash equivalents are held for working capital purposes. We do not enter into investments for trading or speculative purposes. There was no material interest rate risk for the three months ended March 31, 2022 and year ended December 31, 2021.

Inflation Risk

We are exposed to inflation risk. Inflationary factors, such as increases in raw material and overhead costs, could impair our operating results. Although there has been a significant increase in inflation recently, it has not had a substantial impact on our results of operations for the three months ended March 31, 2022. However, a higher rate of inflation in the future may have an adverse effect on our ability to recover increasing costs and we might not be able to pass along cost increases to our customers.

Foreign Currency Risk

There was no material foreign currency risk for the three months ended March 31, 2022 and year ended December 31, 2021. Our activities to date have been limited and were conducted in the United States.

Item 4. Controls and Procedures

Evaluation of disclosure controls and procedures

We maintain disclosure controls and procedures (as that term is defined in Rules 13a-15(e) and 15d-15(e) under the Exchange Act) that are designed to ensure that information required to be disclosed in our reports filed or submitted under the Exchange Act is recorded, processed, summarized and reported within the time periods specified in the SEC's rules and forms, and that such information is accumulated and communicated to our management, including our Chief Executive Officer, who serves as our principal executive officer, and Chief Financial Officer, who serves as our principal financial officer, as appropriate, to allow for timely decisions regarding required disclosures. In designing and evaluating our disclosure controls and procedures, management recognizes that any controls and procedures, no matter how well designed and operated, can provide only reasonable assurance of achieving the desired control objectives. In addition, the design of disclosure controls and procedures must reflect the fact that there are resource constraints, and that management is required to apply judgment in evaluating the benefits of possible controls and procedures relative to their costs.

Our management, with the participation of our principal executive officer and principal financial officer, evaluated, as of the end of the period covered by this quarterly report on Form 10-Q, the effectiveness of our disclosure controls and procedures (as that term is defined in Rules 13a-15(e) and 15d-15(e) under the Exchange Act). Based on that evaluation, our principal executive officer and principal financial officer concluded that our disclosure controls and procedures were not effective as of March 31, 2022 due to the material weaknesses in our internal control over financial reporting described below.

Material Weaknesses and Remediation Plan

As previously disclosed, we have identified material weaknesses in our internal control over financial reporting and these material weaknesses continued to exist as of March 31, 2022. A material weakness is a deficiency, or a combination of deficiencies, in internal control over financial reporting such that there is a reasonable possibility that a material misstatement of our annual or interim financial statements will not be prevented or detected on a timely basis. Specifically, material weaknesses identified are:

Control Environment

We did not maintain an effective control environment to enable the identification and mitigation of risks of material accounting errors based on the following control deficiencies:

- We did not design and maintain effective controls over segregation of duties and related conflicts with respect to our information technology systems, including administrative access to our financially relevant information technology systems.
- We did not design and maintain effective controls over formalizing our accounting policies and procedures.
- We did not design and maintain effective controls over preparing and recording journal entries within our accounting systems related thereto.
- We did not design and maintain effective controls over accounting for complex transactions and instruments, including, the inaccurate accounting for Public and Private Placement Warrants and the inaccurate application of conversion accounting related to our convertible instruments in connection with the restatement of our financial statements for the period ended June 30, 2021 as set forth in our Form 10-Q/A (Amendment No. 1) filed with the SEC on October 22, 2021.

Risk Assessment

We did not design and maintain controls over an effective risk assessment, including: (i) identifying, assessing, and communicating appropriate objectives, (ii) identifying and analyzing risks to achieve these objectives, and (iii) identifying and assessing changes in the business that could impact our system of internal controls.

Control Activities

We did not design and maintain effective control activities as the control activities did not adequately (i) address relevant risks, (ii) provide evidence of performance, (iii) provide appropriate segregation of duties, or (iv) operate at a level of precision to identify all potentially material errors.

Information and Communication

We did not design and implement controls over information and communication relating to communicating accurate information internally and externally, including providing information pursuant to objectives, responsibilities, and functions of internal control.

Monitoring Activities

We did not design and implement effective monitoring controls to ascertain whether the components of internal control are present and functioning.

These material weaknesses resulted in a restatement to Additional paid-in-capital, Accumulated deficit and Adjustment to redemption value on Convertible Preferred Stock as well as audit adjustments to substantially all of our accounts and disclosures, which were recorded as of and for the year ended December 31, 2021. Additionally, these material weaknesses could result in a misstatement of substantially all of our account balances or disclosures that would result in a material misstatement to the annual or interim consolidated financial statements that would not be prevented or detected.

We have begun the process of, and are focused on, designing and implementing effective internal control measures to improve our internal control over financial reporting and remediate the material weaknesses. Our efforts include a number of actions:

- We are actively recruiting additional personnel, in addition to engaging and utilizing third party consultants and specialists to supplement our internal resources and segregate key functions within our business processes, where appropriate.
- We also continue to take actions to improve our IT general controls, segregation of duties controls, period-end financial reporting controls, and journal entry controls.
- We are in the process of formally documenting accounting policies and procedures complying with applicable financial reporting standards.
- We are implementing comprehensive controls over the preparation and review of journal entries, establishing additional controls to verify transactions are properly classified in the financial statements and program change management controls to ensure that IT program and data changes affecting financial IT applications and underlying accounting records are identified, tested, authorized and implemented appropriately.
- While we have processes to identify and evaluate the appropriate accounting technical pronouncements and other literature for all significant or unusual transactions, we are in the process of enhancing these processes to better evaluate, research and understand the nuances of the accounting standards for complex transactions and instruments. We plan to provide internal resources with enhanced access to accounting literature and research materials while increasing communication with third-party professionals with whom we consult regarding the application of accounting standards over complex transactions and instruments.

While these actions and planned actions are subject to ongoing management evaluation and will require validation and testing of the design and operating effectiveness of internal controls over a sustained period, we are committed to continuous improvement and will continue to diligently review our internal control over financial reporting.

Changes in Internal Control over Financial Reporting

There were no changes in our internal control over financial reporting (as that term is defined in Rules 13a-15(f) and 15d-15(f) under the Exchange Act) during the quarter ended March 31, 2022 that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

PART II—OTHER INFORMATION

Item 1. Legal Proceedings

Discussion of legal matters is incorporated by reference from Part I, Item 1, Note 11, “Commitments and Contingencies,” and Note 17, “Subsequent Events” of this Quarterly Report on Form 10-Q, and should be considered an integral part of Part II, Item 1, “Legal Proceedings.”

Item 1A. Risk Factors

There have been no material changes from the risk factors previously disclosed in our Annual Report on Form 10-K for the period ended December 31, 2021, filed with the SEC on March 31, 2022, and investors are encouraged to review these risk factors prior to making an investment in the Company and in conjunction with their review of this Quarterly Report on Form 10-Q.

Item 2. Unregistered Sales of Equity Securities and Use of Proceeds

None.

Item 3. Defaults Upon Senior Securities

None.

Item 4. Mine Safety Disclosures

None.

Item 5. Other Information

None.

Item 6. Exhibits

Exhibit Number	Description	Incorporated by Reference			
		Form	SEC File No.	Exhibit	Filing Date
31.1*	Certification of Chief Executive Officer Pursuant to Rules 13a-14(a) and 15d-14(a) under the Securities Exchange Act of 1934, as Adopted Pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.				
31.2*	Certification of Chief Financial Officer Pursuant to Rules 13a-14(a) and 15d-14(a) under the Securities Exchange Act of 1934, as Adopted Pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.				
32.1**	Certification of Chief Executive Officer Pursuant to 18 U.S.C. Section 1350, as Adopted Pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.				
32.2**	Certification of Chief Financial Officer Pursuant to 18 U.S.C. Section 1350, as Adopted Pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.				
101.INS	Inline XBRL Instance Document – the instance document does not appear in the Interactive Data File because XBRL tags are embedded within the Inline XBRL document.				
101.SCH	Inline XBRL Taxonomy Extension Schema Document				
101.CAL	Inline XBRL Taxonomy Extension Calculation Linkbase Document				
101.DEF	Inline XBRL Taxonomy Extension Definition Linkbase Document				
101.LAB	Inline XBRL Taxonomy Extension Label Linkbase Document				
101.PRE	Inline XBRL Taxonomy Extension Presentation Linkbase Document				
104	Cover Page Interactive Data File (embedded within the Inline XBRL document)				

* Filed herewith.
** Furnished herewith.

SIGNATURES

Pursuant to the requirements of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned thereunto duly authorized.

Astra Space, Inc.

Date: May 5, 2022

By: /s/ Chris C. Kemp
Chris C. Kemp
Chief Executive Officer

Date May 5, 2022

By: /s/ Kelyn J. Brannon
Kelyn J. Brannon
Chief Financial Officer, Principal Financial Officer and Principal Accounting Officer

Exhibit 31.1

CERTIFICATION PURSUANT TO
RULES 13a-14(a) AND 15d-14(a) UNDER THE SECURITIES EXCHANGE ACT OF 1934,
AS ADOPTED PURSUANT TO SECTION 302 OF THE SARBANES-OXLEY ACT OF 2002

I, Chris Kemp, certify that:

1. I have reviewed this Quarterly Report on Form 10-Q of Astra Space, Inc.;

2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4. The registrant's other certifying officer and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

   (a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

   (b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

   (c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

   (d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5. The registrant's other certifying officer and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):

   (a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

   (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: May 5, 2022

By: /s/ Chris C. Kemp
Chris C. Kemp
Chief Executive Officer

Exhibit 31.2

CERTIFICATION PURSUANT TO
RULES 13a-14(a) AND 15d-14(a) UNDER THE SECURITIES EXCHANGE ACT OF 1934,
AS ADOPTED PURSUANT TO SECTION 302 OF THE SARBANES-OXLEY ACT OF 2002

I, Kelyn Brannon, certify that:

1. I have reviewed this Quarterly Report on Form 10-Q of Astra Space, Inc.;

2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4. The registrant's other certifying officer and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

   (a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

   (b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

   (c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

   (d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5. The registrant's other certifying officer and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):

   (a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

   (b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: May 5, 2022

By: /s/ Kelyn J. Brannon
Kelyn J. Brannon
Chief Financial Officer

Exhibit 32.1

CERTIFICATION PURSUANT TO
18 U.S.C. SECTION 1350, AS ADOPTED PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002

In connection with the Quarterly Report of Astra Space, Inc. (the "Company") on Form 10-Q for the period ended March 31, 2022 as filed with the Securities and Exchange Commission on the date hereof (the "Report"), I certify, pursuant to 18 U.S.C. § 1350, as adopted pursuant to § 906 of the Sarbanes-Oxley Act of 2002, that:

(1) The Report fully complies with the requirements of section 13(a) or 15(d) of the Securities Exchange Act of 1934; and

(2) The information contained in the Report fairly presents, in all material respects, the financial condition and result of operations of the Company.

Date: May 5, 2022

By: /s/ Chris C. Kemp
Chris C. Kemp
Chief Executive Officer

Exhibit 32.2

CERTIFICATION PURSUANT TO
18 U.S.C. SECTION 1350, AS ADOPTED PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002

In connection with the Quarterly Report of Astra Space, Inc. (the "Company") on Form 10-Q for the period ended March 31, 2022 as filed with the Securities and Exchange Commission on the date hereof (the "Report"), I certify, pursuant to 18 U.S.C. § 1350, as adopted pursuant to § 906 of the Sarbanes-Oxley Act of 2002, that:

(1) The Report fully complies with the requirements of section 13(a) or 15(d) of the Securities Exchange Act of 1934; and

(2) The information contained in the Report fairly presents, in all material respects, the financial condition and result of operations of the Company.

Date: May 5, 2022

By: /s/ Kelyn J. Brannon
Kelyn J. Brannon
Chief Financial Officer

Exhibit 32.2

CERTIFICATION PURSUANT TO
18 U.S.C. SECTION 1350, AS ADOPTED PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002

In connection with the Quarterly Report of Astra Space, Inc. (the "Company") on Form 10-Q for the period ended March 31, 2022 as filed with the Securities and Exchange Commission on the date hereof (the "Report"), I certify, pursuant to 18 U.S.C. § 1350, as adopted pursuant to § 906 of the Sarbanes-Oxley Act of 2002, that:

(1) The Report fully complies with the requirements of section 13(a) or 15(d) of the Securities Exchange Act of 1934; and

(2) The information contained in the Report fairly presents, in all material respects, the financial condition and result of operations of the Company.

Date: May 5, 2022

By: /s/ Kelyn J. Brannon
Kelyn J. Brannon
Chief Financial Officer

UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549

FORM 8-K

CURRENT REPORT
Pursuant to Section 13 or 15(d)
of the Securities Exchange Act of 1934

Date of Report (Date of earliest event reported): May 6, 2022

Astra Space, Inc.
(Exact name of Registrant as Specified in Its Charter)

Delaware	001-39426	85-1270303
(State or Other Jurisdiction of Incorporation)	(Commission File Number)	(IRS Employer Identification No.)

1900 Skyhawk Street Alameda, California	94501
(Address of Principal Executive Offices)	(Zip Code)

Registrant's Telephone Number, Including Area Code: (866) 278-7217

Check the appropriate box below if the Form 8-K filing is intended to simultaneously satisfy the filing obligation of the registrant under any of the following provisions:

☐ Written communications pursuant to Rule 425 under the Securities Act (17 CFR 230.425)

☐ Soliciting material pursuant to Rule 14a-12 under the Exchange Act (17 CFR 240.14a-12)

☐ Pre-commencement communications pursuant to Rule 14d-2(b) under the Exchange Act (17 CFR 240.14d-2(b))

☐ Pre-commencement communications pursuant to Rule 13e-4(c) under the Exchange Act (17 CFR 240.13e-4(c))

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
Class A common stock, par value $0.0001 per share	**ASTR**	**NASDAQ Global Select Market**

Indicate by check mark whether the registrant is an emerging growth company as defined in Rule 405 of the Securities Act of 1933 (§230.405 of this chapter) or Rule 12b-2 of the Securities Exchange Act of 1934 (§240.12b-2 of this chapter).

Emerging growth company ☐

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ☐

Item 8.01 Other Events.

On May 6, 2022, Astra Space, Inc. (the "Company") posted a blog on its website at www.astra.com related to the communication of its launch dates. A copy of our blog post is attached hereto as Exhibit 99.1.

Item 9.01 Financial Statements and Exhibits.

(d) Exhibits

Exhibit No.	Description
99.1	Blog post issued by Astra Space, Inc. dated May 6, 2022
104	Cover Page Interactive Data File (embedded with the Inline XBRL document)

SIGNATURES

Pursuant to the requirements of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned thereunto duly authorized.

Date: May 6, 2022

Astra Space, Inc.

By: /s/ Kelyn Brannon
Name: Kelyn Brannon
Title: Chief Financial Officer

Exhibit 99.1

How We Launch: What it takes to prepare for an orbital launch

By Donald Allen, Senior Director, Program Management—Operations

We are frequently asked: "When is the next launch?"

As the Lead Program Manager for Operations, I love being able to share our launches with the world.

Determining a launch date is not straightforward and publicly announcing that date happens towards the end of a months-long preparation process, not the beginning. There are many factors that affect the timing of launches; the schedule is typically fluid until specific conditions are met, which is why we do not communicate our next launch date until we have confirmed readiness in the following areas:

- **Licensing:** This occurs when our multiple regulators—the FAA, FCC, Air Traffic Control, and Coast Guard—have approved all required licenses and notifications, all of which are required for public safety. The detailed analysis of our trajectory and the radio frequencies we use help to ensure that our rocket does not create a hazard for people who may be near the launch site, and further afield in the path our vehicle takes to orbit. These include notifications to pilots (NOTAM), notifications to sea vessels (NOTMAR) and receipt of both the spaceport/range approval and the launch license. Filing for a license to launch is not a guarantee that a launch will occur.
- **Customer:** This occurs when the customer has prepared its payload for integration into our launch vehicle. Payload readiness includes ensuring that the payload can travel to the payload integration location, that the environment at this location can be controlled, and that the payload can connect and "speak" to the rocket.
- **Range:** This occurs when the range/launch site approves our launch date(s). This approval is contingent on range logistics and capacity, and avoiding conflict with other customers' schedules. Requesting a launch date is not a guarantee, and those dates we request are often shifted as the range goes through their own deconfliction process.
- **Weather:** We closely monitor weather reports at the range/launch site and have to remain flexible if there are forecasted weather events that could be unfavorable to launch, such as heavy wind and lightning. If the process of range deconfliction, customer readiness, or licensing causes the projected launch date to change into another month, it impacts the licensing analysis, causing additional licensing work.
- **Astra:** Bringing together the Astra Launch System, including a completed rocket, launcher system and running through our built-in tests and procedures to make sure every component is ready for launch is critical to the success of every mission. Astra's mobile-first launch system allows for more flexibility than systems that use fixed infrastructure at the launch site. The agility built into the system allows us to flex our scheduling to align with the other partners in this process.

As Astra increases its launch cadence, we are also pushing the boundaries of the support environment, from regulatory agencies to the launch capacity of the ranges. Because of these interdependencies, we only communicate dates when we have a reasonably high degree of certainty that that we will have met these conditions.

Achieving daily launch

While there are complexities to announcing the next launch, Astra aims to achieve a daily launch capability by: (a) expanding the number of spaceports, (b) using private and exclusive-use launch sites, (c) leveraging streamlined regulatory processes, such as the FAA's Part 450 License, (d) using its existing mobile launch capability, and (e) requiring limited infrastructure at the launch site.

Astra is the official source

There is a lot of speculation online about our launch dates and even websites that publish our supposed launch dates; **these websites are not a reliable source of information** as they do not have access to all of the data necessary to determine a launch date. We will officially announce launch dates on Twitter after we receive approvals from the range/launch sites and applicable regulatory authorities. Twitter is also our priority channel for communicating launch ops updates.

NASA TROPICS

Right now, there is a lot of interest in the status of the NASA TROPICS mission. TROPICS will allow NASA to create more detailed data on tropical storm development while also proving the effectiveness of multiple smaller satellites working in tandem.

Currently, the LV0010 rocket and the first payloads for the NASA TROPICS mission are ready for this launch, and we are awaiting approval from the range/launch site and regulators to announce launch dates. Our license with the FAA will cover all three TROPICS missions, which we expect to receive in the next few weeks. Follow us on Twitter for the latest developments.

Safe Harbor Statement

Certain statements made in this blog are "forward-looking statements". Forward-looking statements may be identified by the use of words such as "anticipate", "believe", "expect", "estimate", "plan", "outlook", and "project" and other similar expressions that predict or indicate future events or trends or that are not statements of historical matters. These forward-looking statements reflect the current analysis of existing information and are subject to various risks and uncertainties. As a result, caution must be exercised in relying on forward-looking statements. The following factors, among others, could cause actual results to differ materially from those described in these forward-looking statements: (i) our failure to meet projected development and delivery targets, including as a result of the decisions of governmental authorities or other third parties not within our control; (ii) changes in applicable laws or regulations; (iii) the ability of the Astra to meet its financial and strategic goals, due to, among other things, competition; (iv) the ability of Astra to pursue a growth strategy and manage growth profitability; (v) the possibility that Astra may be adversely affected by other economic, business, and/or competitive factors; (vi) the effect of the COVID-19 pandemic on Astra and (vii) other risks and uncertainties described discussed from time to time in other reports and other public filings with the Securities and Exchange Commission, including our registration statements and quarterly reports.

UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549

FORM 8-K

CURRENT REPORT
Pursuant to Section 13 or 15(d)
of the Securities Exchange Act of 1934

Date of Report (Date of earliest event reported): May 10, 2022

Astra Space, Inc.
(Exact name of Registrant as Specified in Its Charter)

Delaware	001-39426	85-1270303
(State or Other Jurisdiction of Incorporation)	(Commission File Number)	(IRS Employer Identification No.)
1900 Skyhawk Street Alameda, California (Address of Principal Executive Offices)		94501 (Zip Code)

Registrant's Telephone Number, Including Area Code: (866) 278-7217

Check the appropriate box below if the Form 8-K filing is intended to simultaneously satisfy the filing obligation of the registrant under any of the following provisions:

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☐ Pre-commencement communications pursuant to Rule 13e-4(c) under the Exchange Act (17 CFR 240.13e-4(c))

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
Class A common stock, par value $0.0001 per share	ASTR	NASDAQ Global Select Market

Indicate by check mark whether the registrant is an emerging growth company as defined in Rule 405 of the Securities Act of 1933 (§ 230.405 of this chapter) or Rule 12b-2 of the Securities Exchange Act of 1934 (§ 240.12b-2 of this chapter).

Emerging growth company ☐

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ☐

Item 8.01 Other Events.

On May 10, 2022, Astra Space, Inc. (the "Company") announced that, subject to the entry of definitive agreements and receipt of regulatory approvals, the Company and SaxaVord UK Spaceport are partnering to increase access to space, by providing dedicated orbital launch services. A copy of our press release is attached hereto as Exhibit 99.1.

Item 9.01 Financial Statements and Exhibits.

(d) Exhibits

Exhibit No.	Description
99.1	Press release issued by Astra Space, Inc. on May 10, 2022
104	Cover Page Interactive Data File (embedded with the Inline XBRL document)

SIGNATURES

Pursuant to the requirements of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned thereunto duly authorized.

Date: May 10, 2022

Astra Space, Inc.

By: /s/ Kelyn Brannon
Name: Kelyn Brannon
Title: Chief Financial Officer

Exhibit 99.1

Astra Looks to Expand Launch Capacity with SaxaVord UK Spaceport

SaxaVord UK Spaceport expected to accelerate Astra's launch cadence in 2023

ALAMEDA, CA – May 10, 2022. Astra Space, Inc. ("Astra") (Nasdaq: ASTR) and SaxaVord UK Spaceport today announced that they are partnering to increase access to space, by providing dedicated orbital launch services to a growing satellite market. Subject to the entry of definitive agreements and regulatory approvals, rocket launches are expected to begin in 2023.

"This agreement between SaxaVord Spaceport and Astra is great news for Shetland and represents another step towards our shared ambition of bringing vertical launch satellite capability to Scotland," said Ivan McKee, Scottish Minister for Business, Trade, Tourism and Enterprise. "Companies like this are vital to achieving the aims of our National Strategy for Economic Transformation that will support a nation of entrepreneurs and innovators in areas like small satellite technology and Scotland's growing space industry."

With its flexible, mobile approach, Astra can transport and connect a fully functional launch system to a simple concrete pad for launches. SaxaVord UK Spaceport would expand Astra's capacity at key inclinations. Together, they are expected to accelerate access to space for customers launching in the UK.

"Astra is an agile, fast-moving company on pace to establish a successful track record," said Robin Huber, Director of Business Development at SaxaVord UK Spaceport. "We look forward to working with their team to build new launch capabilities in the UK. Their mission to improve life on Earth from space is closely aligned with our own values, and we believe that this exciting new relationship will develop into a strong, lasting partnership."

"The additional inclinations, flexibility and launch capacity that this partnership enables will allow us to meet the needs of Astra's customers and align directly with SaxaVord UK Spaceport's economic investment and environmental goals," said Matt Ganser, Vice President of Business Operations at Astra. "We are excited to work with this partner to open another spaceport from which we would hope to meet the growing demand for dedicated launch out of the UK."

"This new partnership between Astra and SaxaVord UK Spaceport is another great example of the strong interest from the international space community in operating from UK spaceports," said Matt Archer, Director of Commercial Space at the UK Space Agency. "By attracting global partners and developing a home-grown launch industry, we can cater for the diverse needs of small satellite manufacturers and operators, while benefitting people and businesses across the UK. It is fantastic to welcome Astra into the UK's thriving launch community."

Learn more about expanded launch capacity at Astra's inaugural Spacetech Day, which will be webcast live on the Company's investor relations website at approximately 9 am PT, with a replay will be available following the event. Visit http://astra.com/spacetech-day-2022 to register.

About Astra

Astra's mission is to improve life on Earth from space by creating a healthier and more connected planet. Today, Astra offers one of the lowest cost-per-launch dedicated orbital launch services of any operational launch provider in the world. Astra delivered its first commercial payload into earth orbit in 2021, making it the fastest company in history to reach this milestone, just five years after it was founded in 2016. Astra (NASDAQ: ASTR) was the first space launch company to be publicly traded on Nasdaq. Visit astra.com to learn more about Astra.

About SaxaVord UK Spaceport

SaxVord Spaceport (SaxaVord) is the UK's first vertical satellite launch facility and ground station located at Lamba Ness in Unst, Shetland. Given Unst is the UK's highest point of latitude, SaxaVord offers customers a geographic competitive advantage enabling unrivalled payloads per satellite, launch site operations, a network of ground stations and in-orbit data collection and analysis. SaxaVord has received endorsement from the UK Space Agency's (UKSA) Spectre Report, formed industry-leading partnerships and has been chosen to host the UKSA's UK Pathfinder launch, which will be delivered by Lockheed Martin and ABL Systems, in 2022.

SaxaVord has secured planning permission for the launch site, which will be designed for small rockets delivering payloads into low earth orbit.

Integral to the UK's space economy ambitions, SaxaVord is building a highly skilled workforce, championing STEM education and supporting the economic regeneration of the Shetlands. Follow the journey of SaxaVord, from ground-breaking to launch, here.

Safe Harbor Statement

Certain statements made in this press release are "forward-looking statements". Forward-looking statements may be identified by the use of words such as "anticipate", "believe", "expect", "estimate", "plan", "outlook", and "project" and other similar expressions that predict or indicate future events or trends or that are not statements of historical matters. These forward-looking statements reflect the current analysis of existing information and are subject to various risks and uncertainties. As a result, caution must be exercised in relying on forward-looking statements. The following factors, among others, could cause actual results to differ materially from those described in these forward-looking statements: (i) our failure to meet projected development and delivery targets, including as a result of the decisions of governmental authorities or other third parties not within our control; (ii) changes in applicable laws or regulations; (iii) the ability of the Astra to meet its financial and strategic goals, due to, among other things, competition; (iv) the ability of Astra to pursue a growth strategy and manage growth profitability; (v) the possibility that Astra may be adversely affected by other economic, business, and/or competitive factors; (vi) the effect of the COVID-19 pandemic on Astra, (vii) the inability to reach a definitive agreement with Saxavord UK Spaceport on terms that are acceptable to us or to obtain the appropriate regulatory approvals; and (viii) other risks and uncertainties described discussed from time to time in other reports and other public filings with the Securities and Exchange Commission, including our registration statements and quarterly reports.

Astra Media Contact:

Kati Dahm
kati@astra.com

SaxaVord Media Contact:

Paul Riddell

UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549

FORM 8-K

CURRENT REPORT
Pursuant to Section 13 or 15(d)
of the Securities Exchange Act of 1934

Date of Report (Date of earliest event reported): May 12, 2022

Astra Space, Inc.
(Exact name of Registrant as Specified in Its Charter)

Delaware	001-39426	85-1270303
(State or Other Jurisdiction of Incorporation)	(Commission File Number)	(IRS Employer Identification No.)

1900 Skyhawk Street Alameda, California	94501
(Address of Principal Executive Offices)	(Zip Code)

Registrant's Telephone Number, Including Area Code: (866) 278-7217

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Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
Class A common stock, par value $0.0001 per share	**ASTR**	**NASDAQ Global Select Market**

Indicate by check mark whether the registrant is an emerging growth company as defined in Rule 405 of the Securities Act of 1933 (§ 230.405 of this chapter) or Rule 12b-2 of the Securities Exchange Act of 1934 (§ 240.12b-2 of this chapter).

Emerging growth company ☐

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ☐

Item 7.01 Regulation FD Disclosure.

On May 12, 2022, we held our inaugural Astra SpaceTech Day at our headquarters and through livestream. The video of the livestream is available on our Twitter account (@astra), our LinkedIn account (linkedin/company/astraspace) and our website at www.astra.com. The PowerPoint slides that were presented in conjunction with Astra SpaceTech Day are included here as Exhibit 99.1.

Once available, we will also furnish the transcript of the livestream of our Astra SpaceTech Day.

Item 9.01 Financial Statements and Exhibits.

(d) Exhibits

Exhibit No.	Description
99.1	Astra SpaceTech Day PowerPoint slides issued on May 12, 2022
104	Cover Page Interactive Data File (embedded with the Inline XBRL document)

SIGNATURES

Pursuant to the requirements of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned thereunto duly authorized.

Date: May 13, 2022

Astra Space, Inc.

By: /s/ Kelyn Brannon
Name: Kelyn Brannon
Title: Chief Financial Officer

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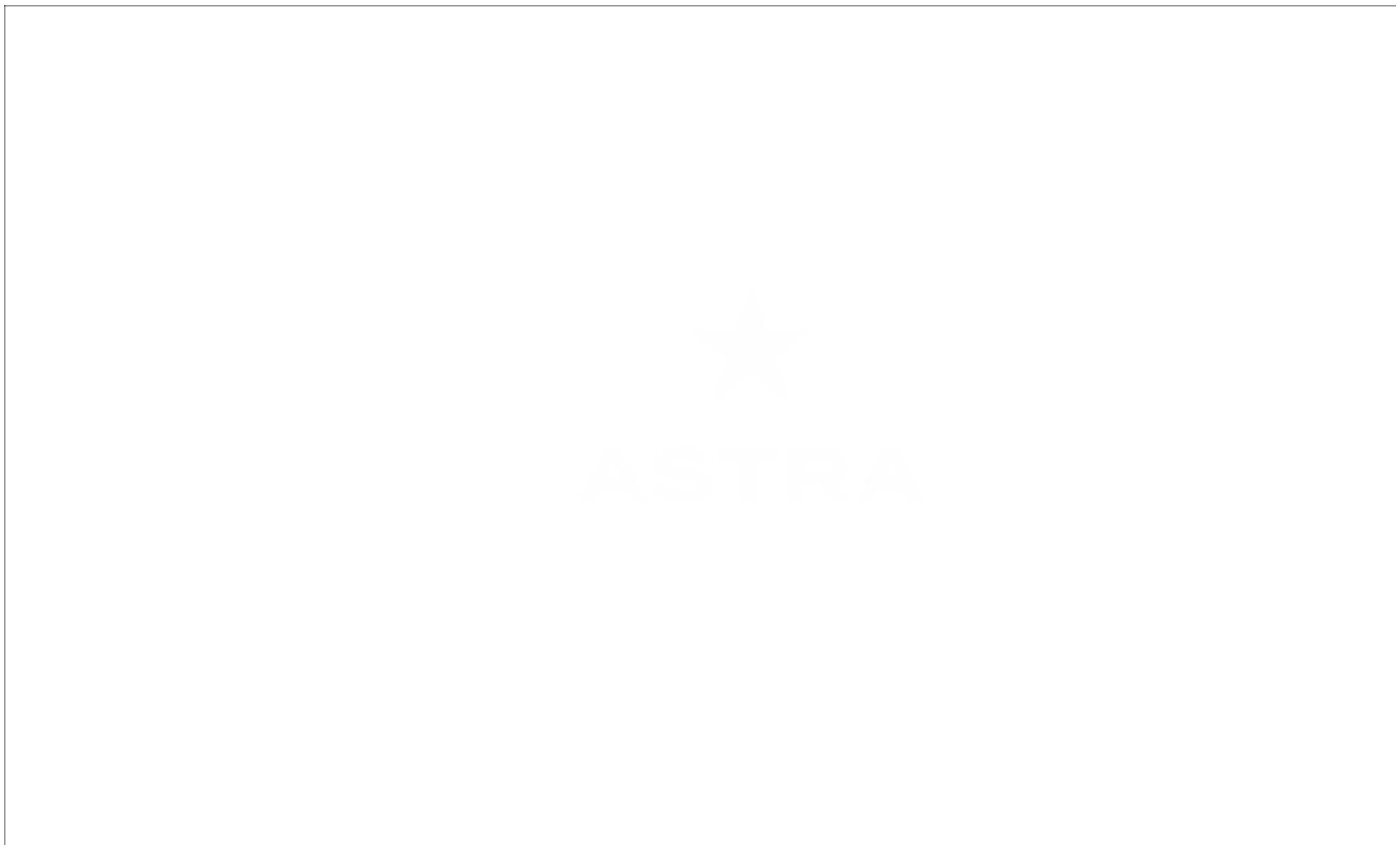
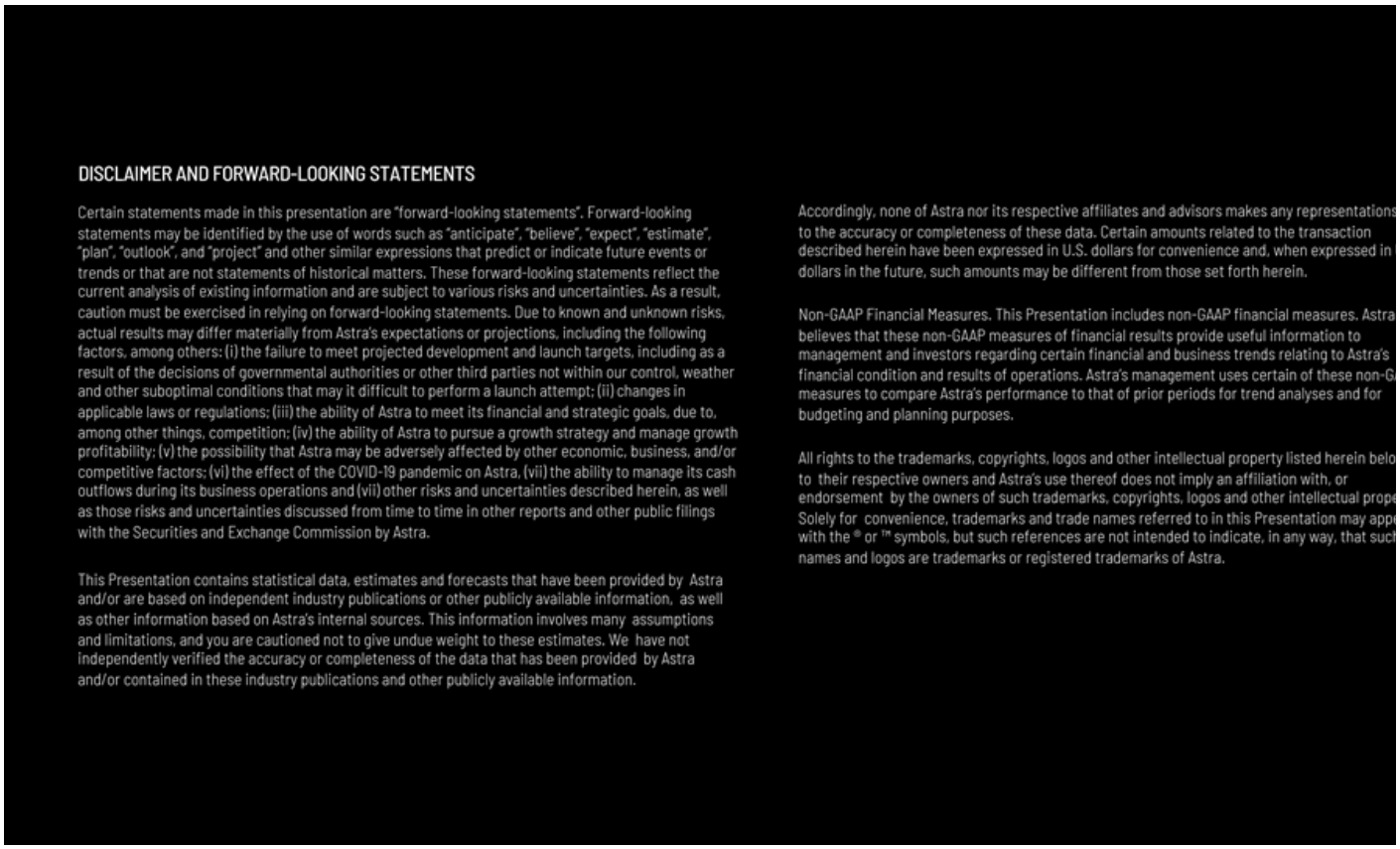



KELYN BRANNON
CHIEF FINANCIAL OFFICER



DISCLAIMER AND FORWARD-LOOKING STATEMENTS

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This Presentation contains statistical data, estimates and forecasts that have been provided by Astra and/or are based on independent industry publications or other publicly available information, as well as other information based on Astra's internal sources. This information involves many assumptions and limitations, and you are cautioned not to give undue weight to these estimates. We have not independently verified the accuracy or completeness of the data that has been provided by Astra and/or contained in these industry publications and other publicly available information.

Accordingly, none of Astra nor its respective affiliates and advisors makes any representations to the accuracy or completeness of these data. Certain amounts related to the transaction described herein have been expressed in U.S. dollars for convenience and, when expressed in dollars in the future, such amounts may be different from those set forth herein.

Non-GAAP Financial Measures. This Presentation includes non-GAAP financial measures. Astra believes that these non-GAAP measures of financial results provide useful information to management and investors regarding certain financial and business trends relating to Astra's financial condition and results of operations. Astra's management uses certain of these non-G measures to compare Astra's performance to that of prior periods for trend analyses and for budgeting and planning purposes.

All rights to the trademarks, copyrights, logos and other intellectual property listed herein belo to their respective owners and Astra's use thereof does not imply an affiliation with, or endorsement by the owners of such trademarks, copyrights, logos and other intellectual prope Solely for convenience, trademarks and trade names referred to in this Presentation may appe with the ® or ™ symbols, but such references are not intended to indicate, in any way, that such names and logos are trademarks or registered trademarks of Astra.

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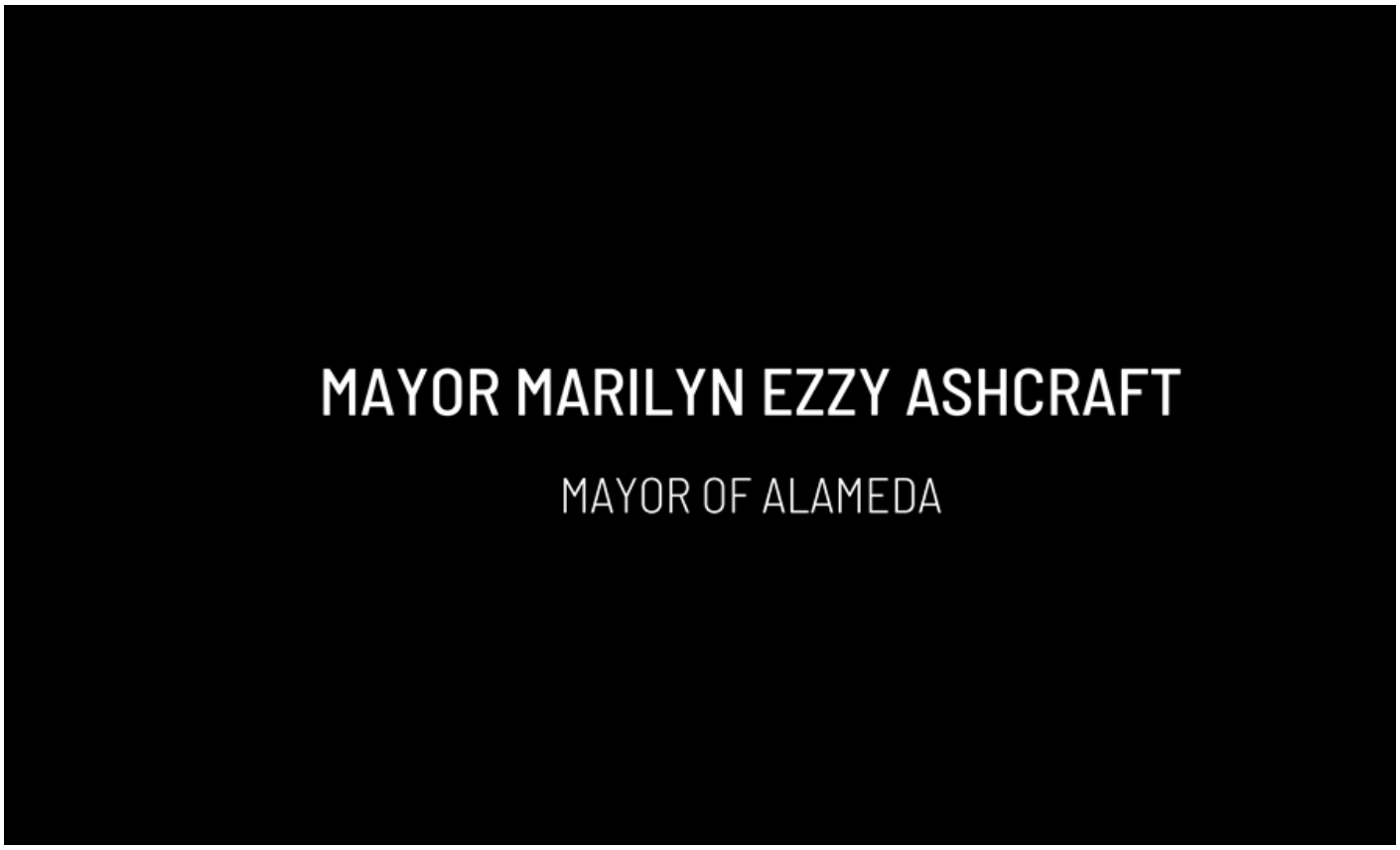


KELYN BRANNON
CHIEF FINANCIAL OFFICER

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IMPROVE LIFE ON EARTH FROM SPACE™

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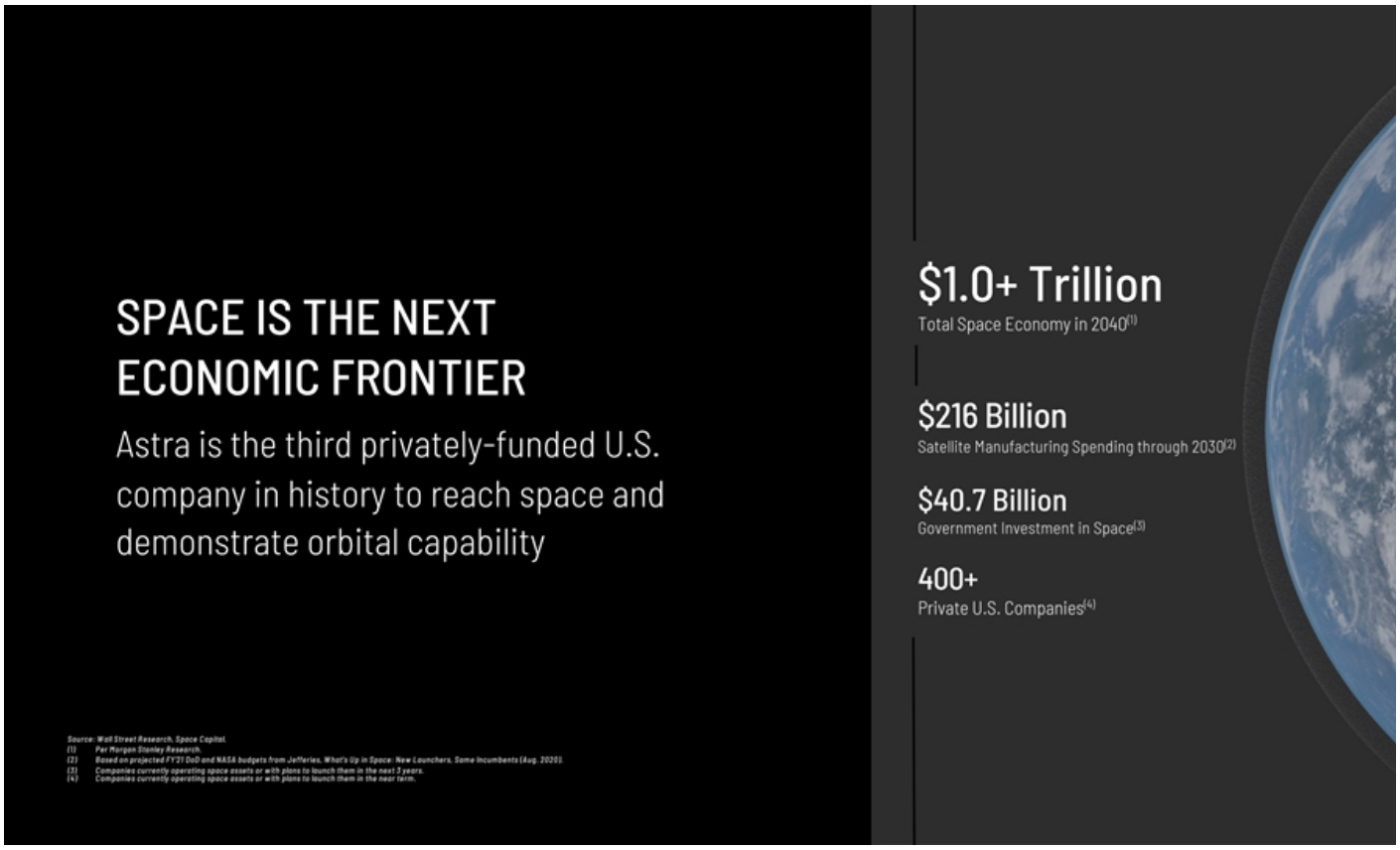
SPACE IS THE NEXT ECONOMIC FRONTIER
Astra is the third privately-funded U.S. company in history to reach space and demonstrate orbital capability
$1.0+ Trillion
Total Space Economy in 2040(1)
$216 Billion
Satellite Manufacturing Spending through 2030(2)
$40.7 Billion
Government Investment in Space(3)
400+
Private U.S. Companies(4)
Source: Wall Street Research, Space Capital.
(1) Per Morgan Stanley Research.
(2) Based on projected FY'21 DoD and NASA budgets from Jefferies, What's Up in Space: New Launchers, Some Incumbents (Aug. 2020).
(3) Companies currently operating space assets or with plans to launch them in the next 3 years.
(4) Companies currently operating space assets or with plans to launch them in the near term.


NUMEROUS MULTI-BILLION DOLLAR MARKETS
GLOBAL BROADBAND CONNECTIVITY
Reliable, low latency connectivity that could leapfrog wireless
IOT / M2M
Monitoring billions of objects
EARTH OBSERVATION
Monitoring activity on earth
NATIONAL SECURITY
Early warning systems
NEXT-GENERATION WEATHER, GPS, AND OTHER SERVICES
Leapfrogging wireless

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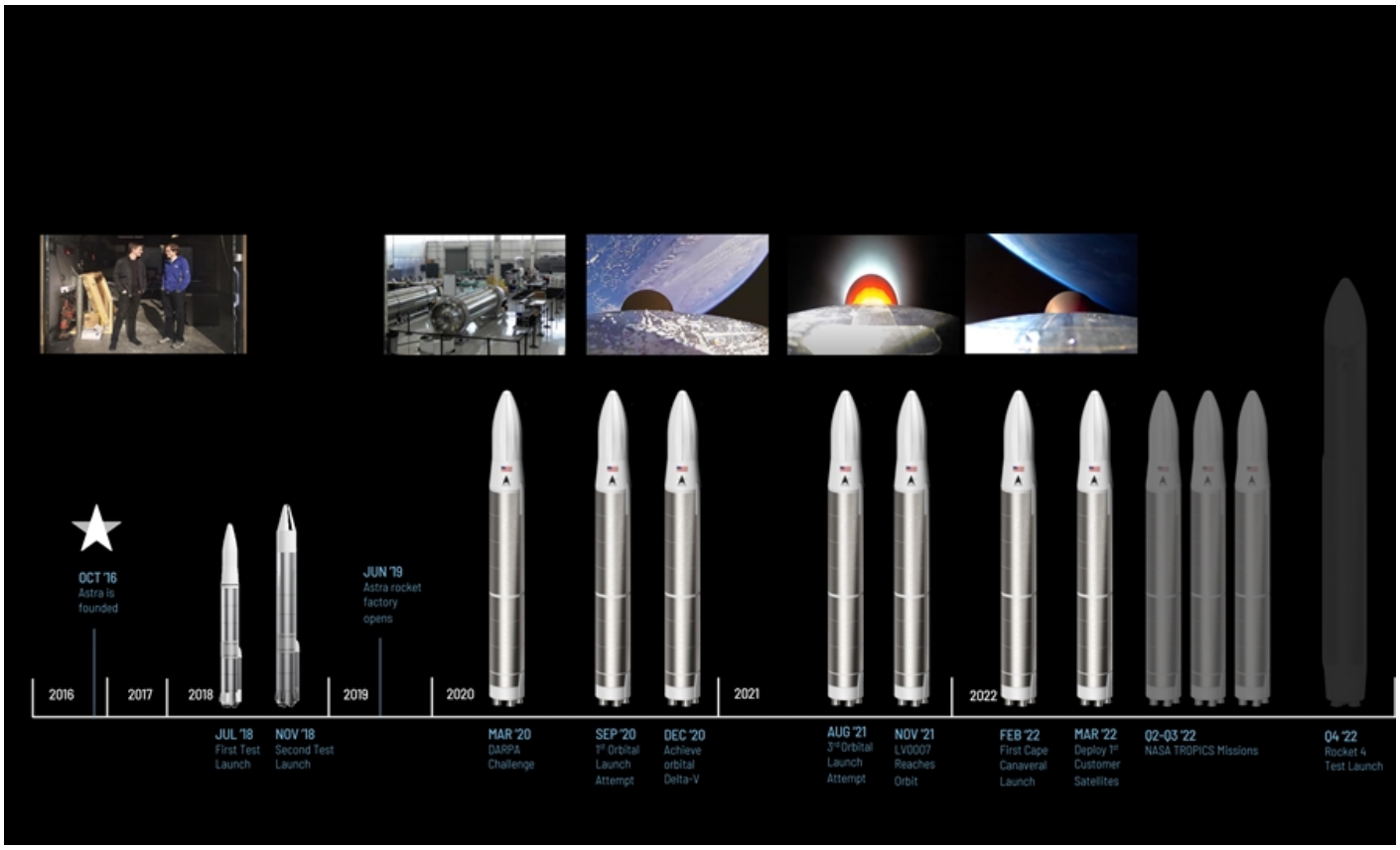

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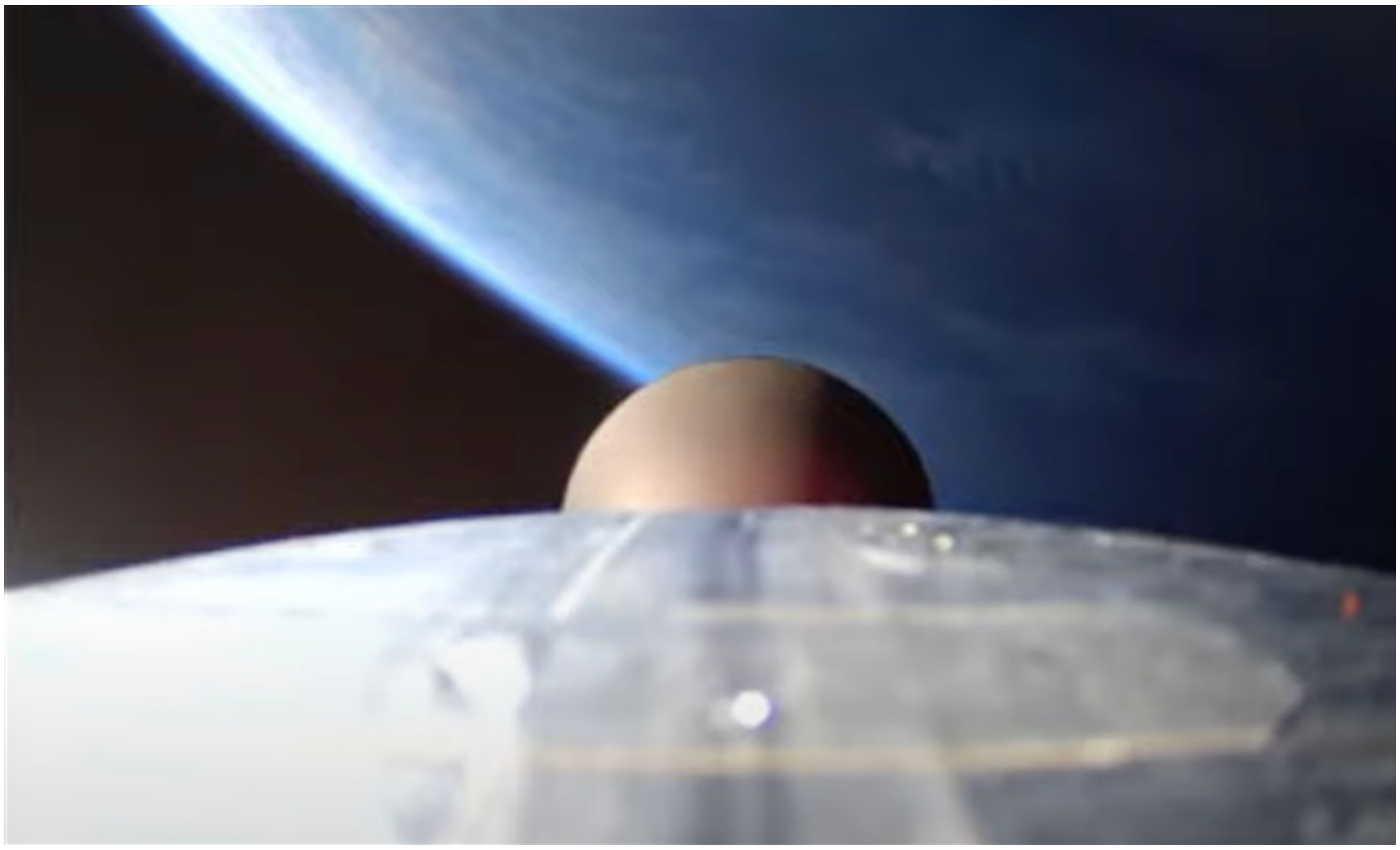

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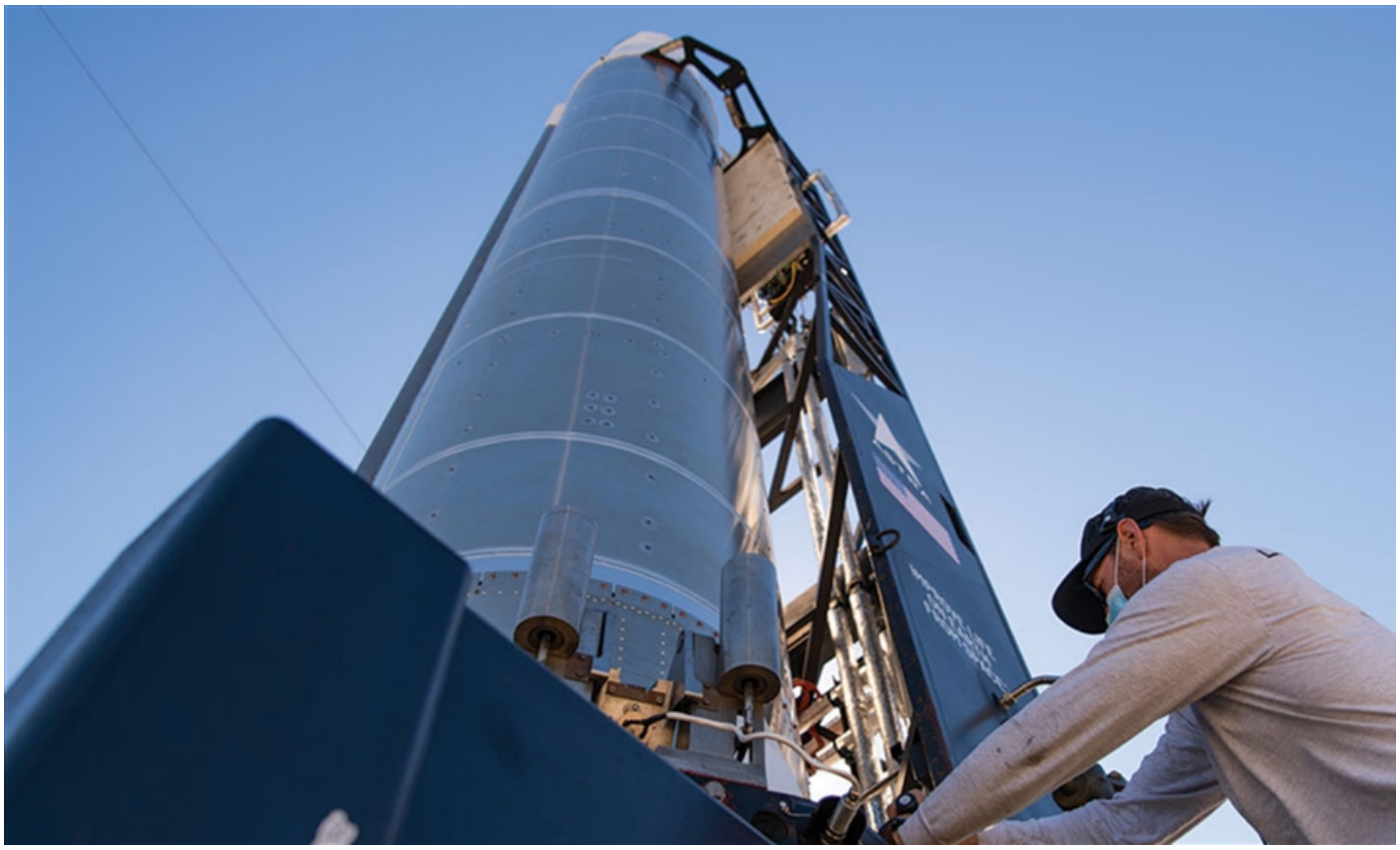

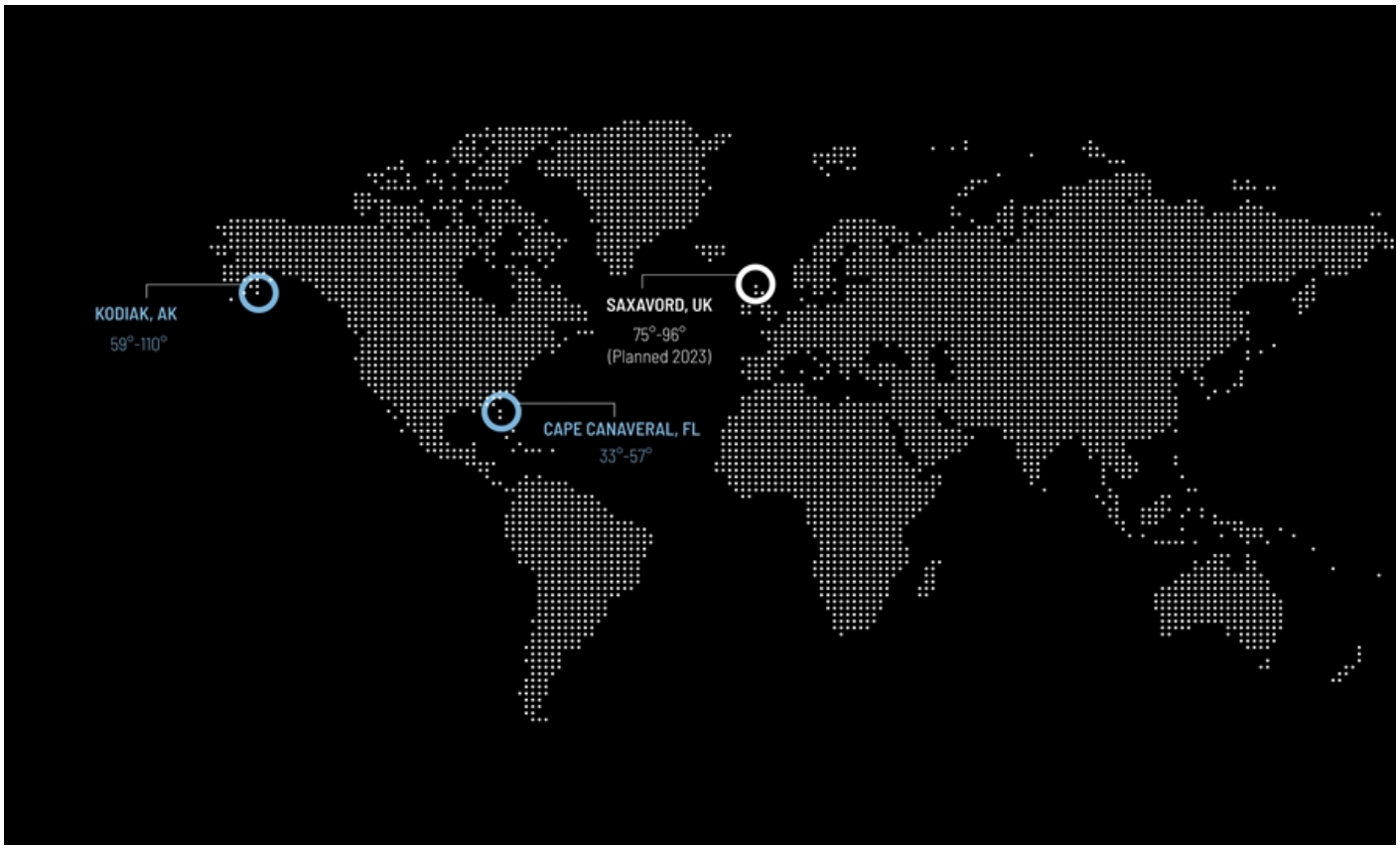
KODIAK, AK
59°-110°
SAXAVORD, UK
75°-96°
(Planned 2023)
CAPE CANAVERAL, FL
33°-57°

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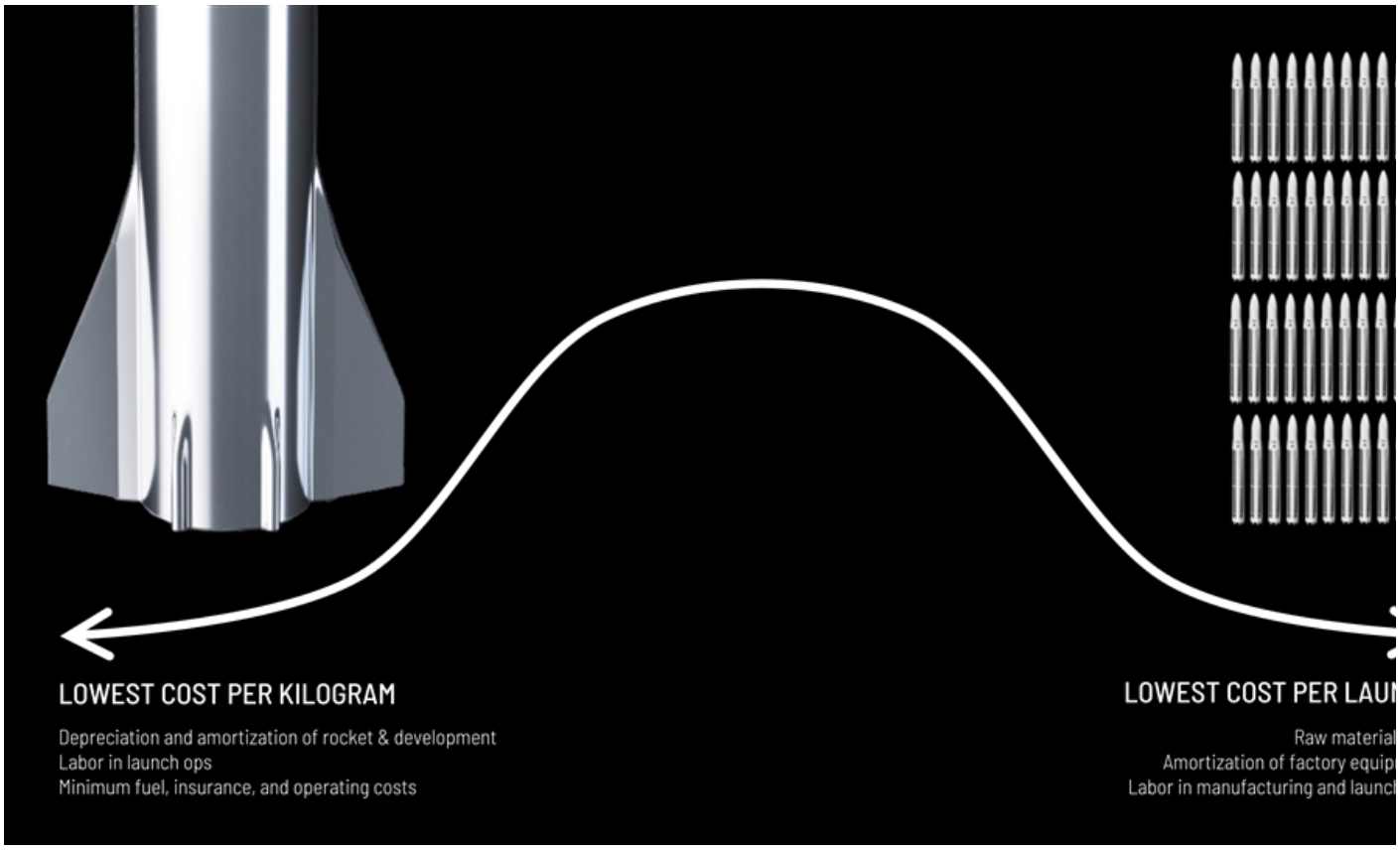

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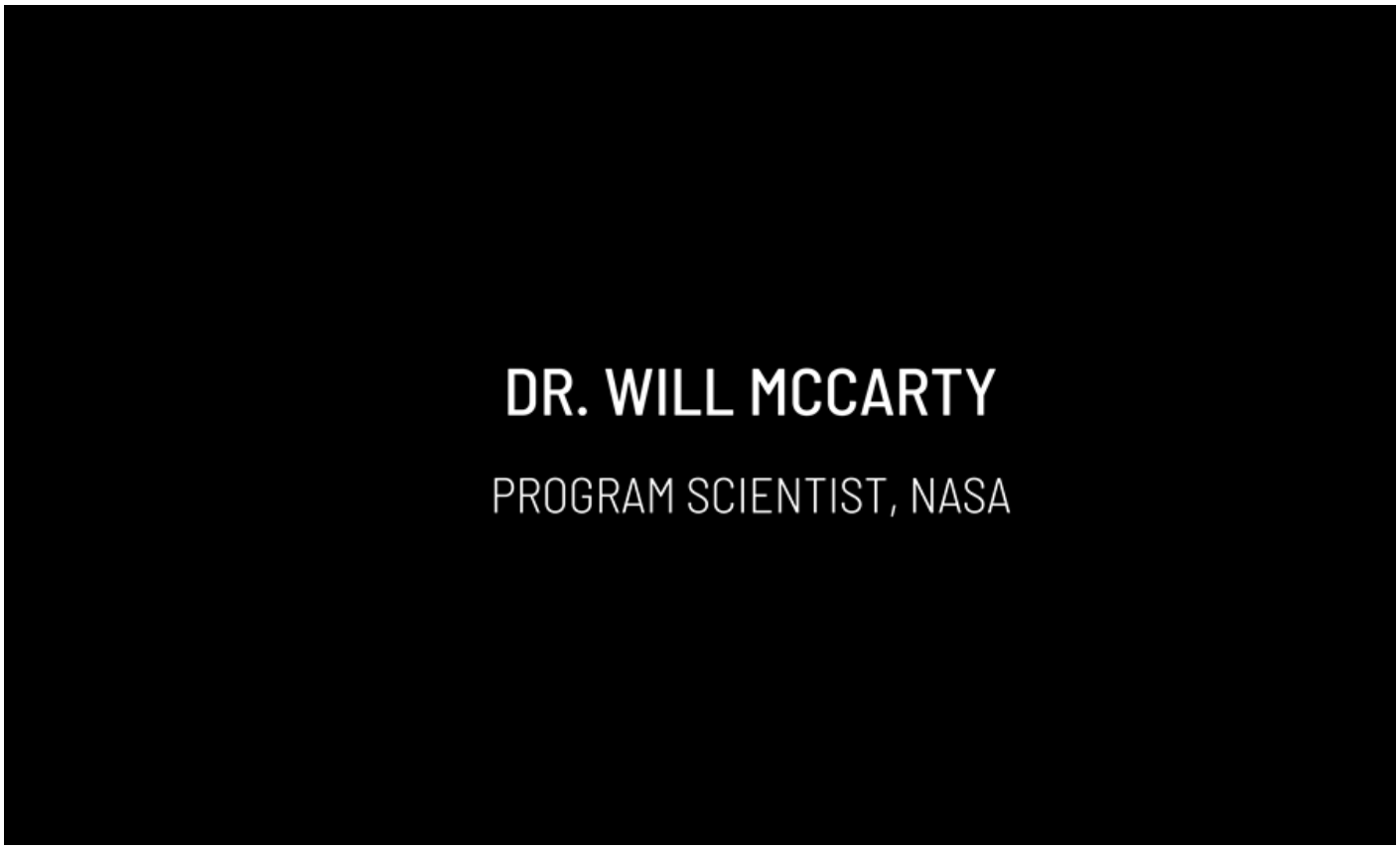

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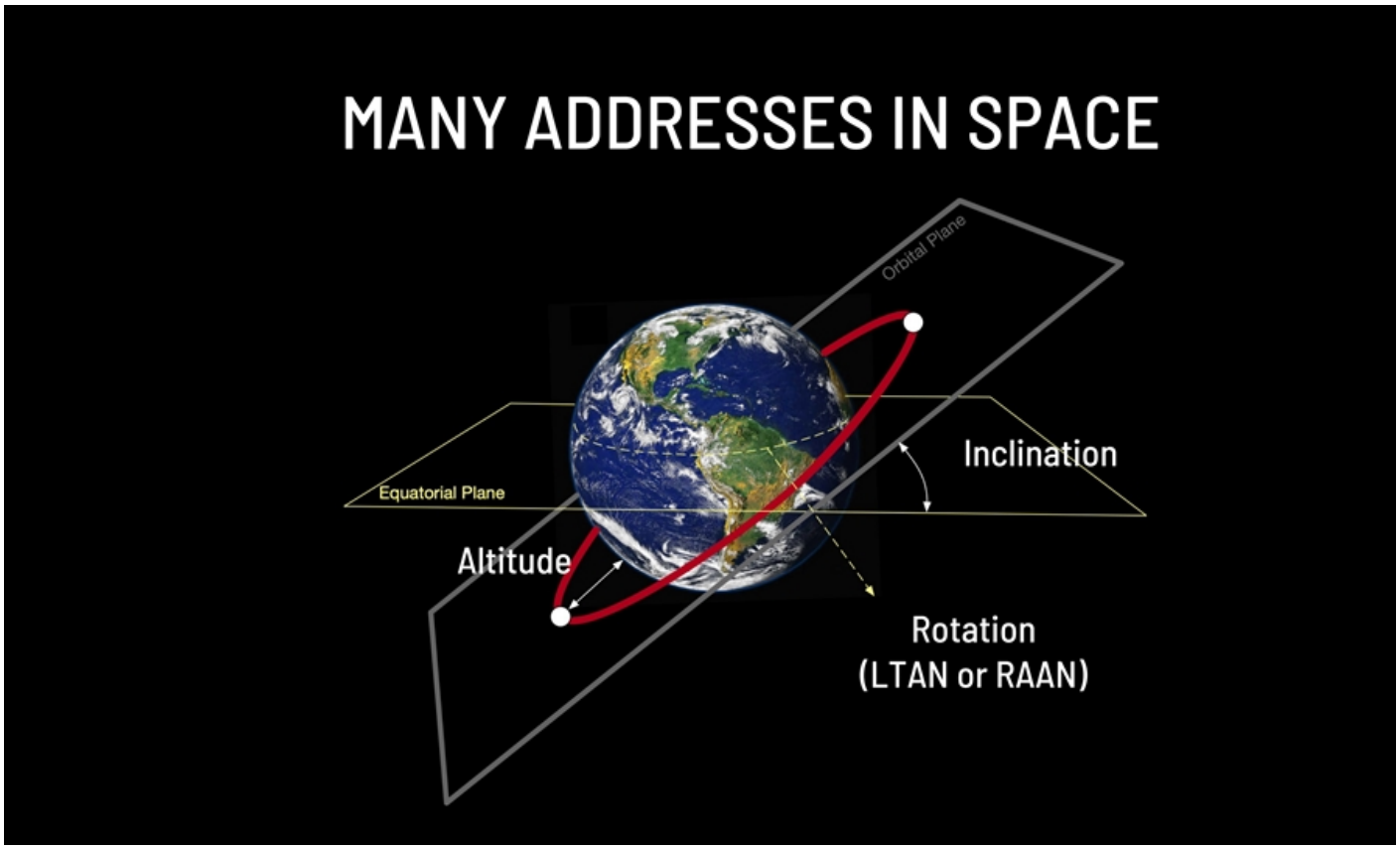

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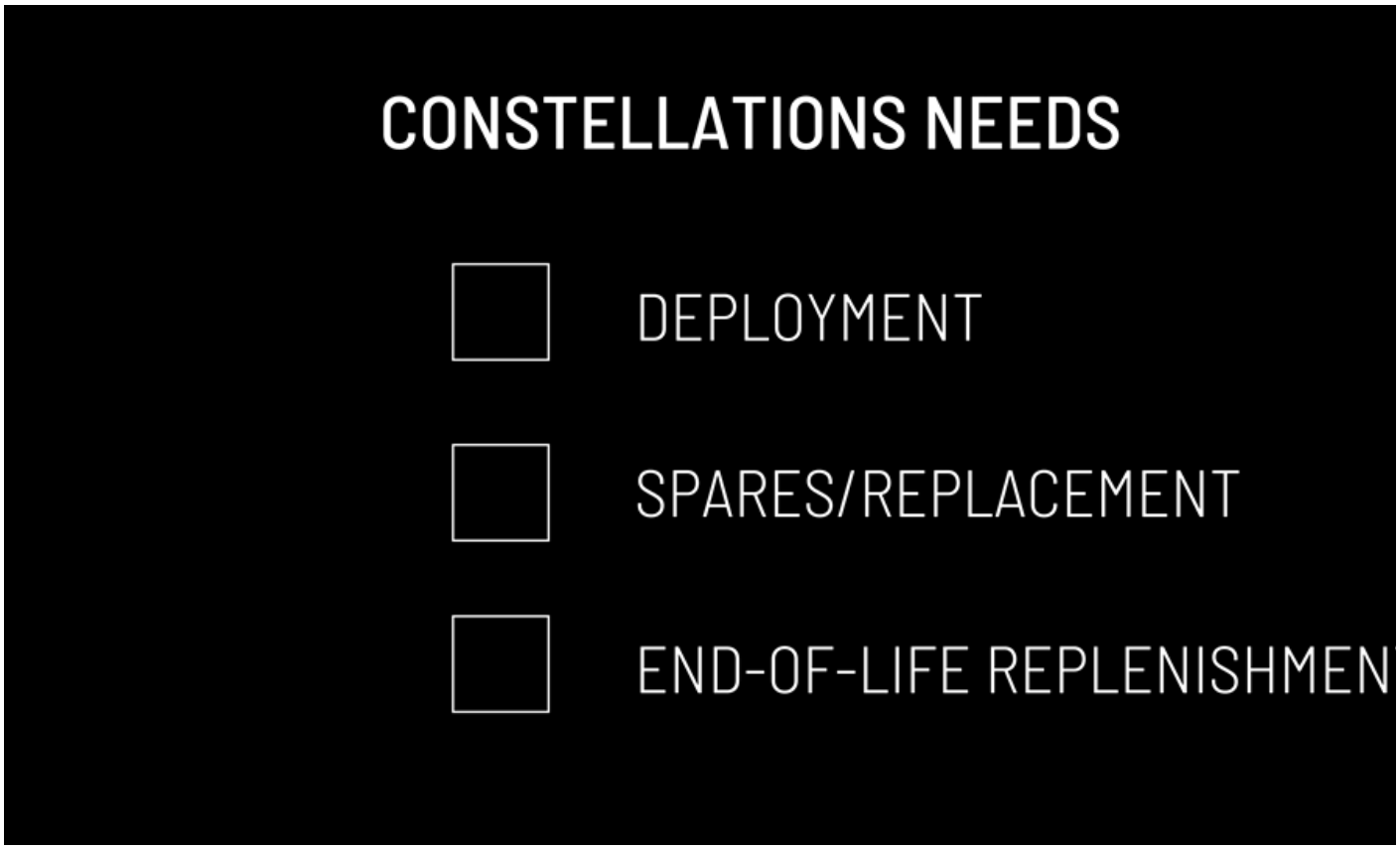

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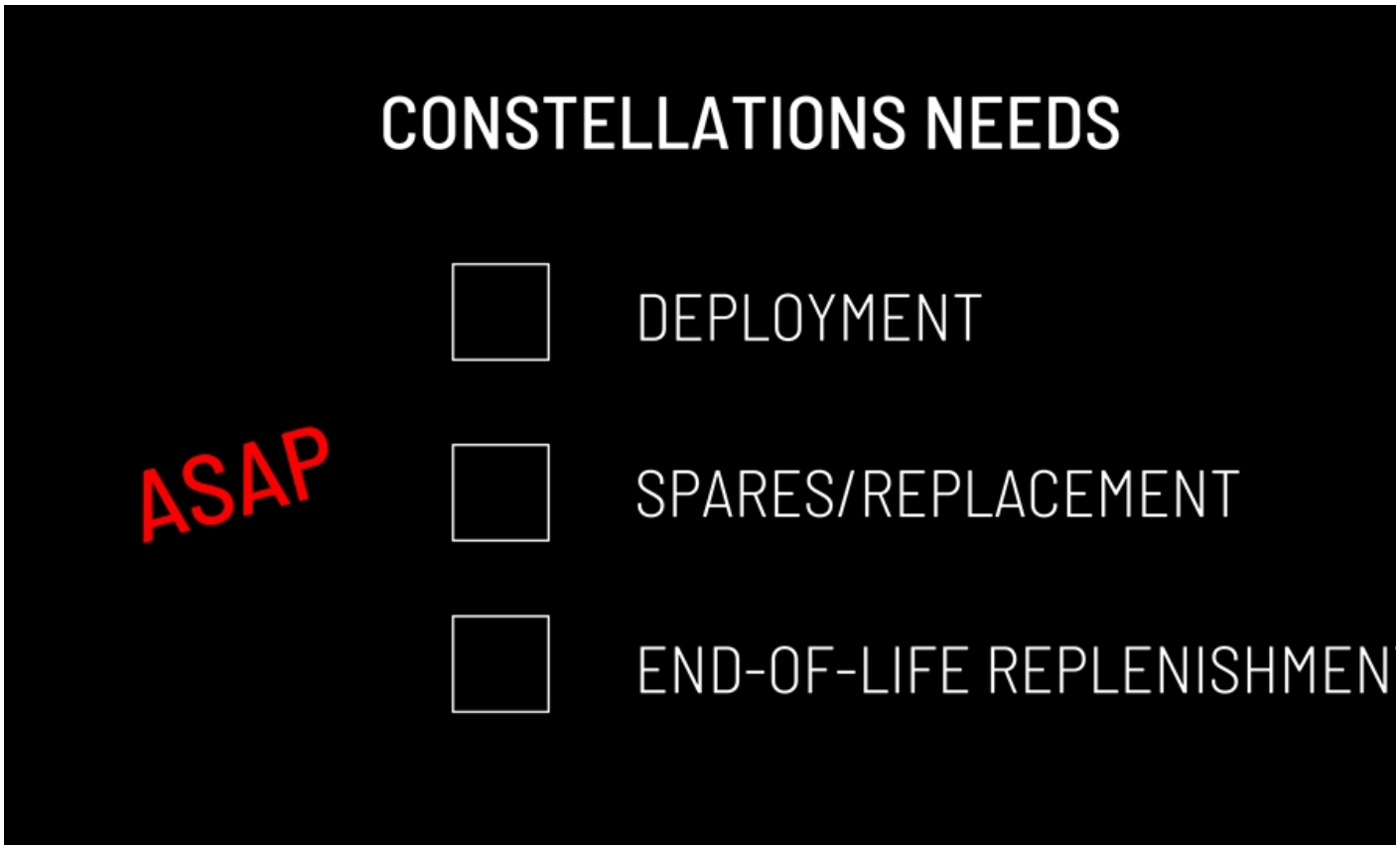

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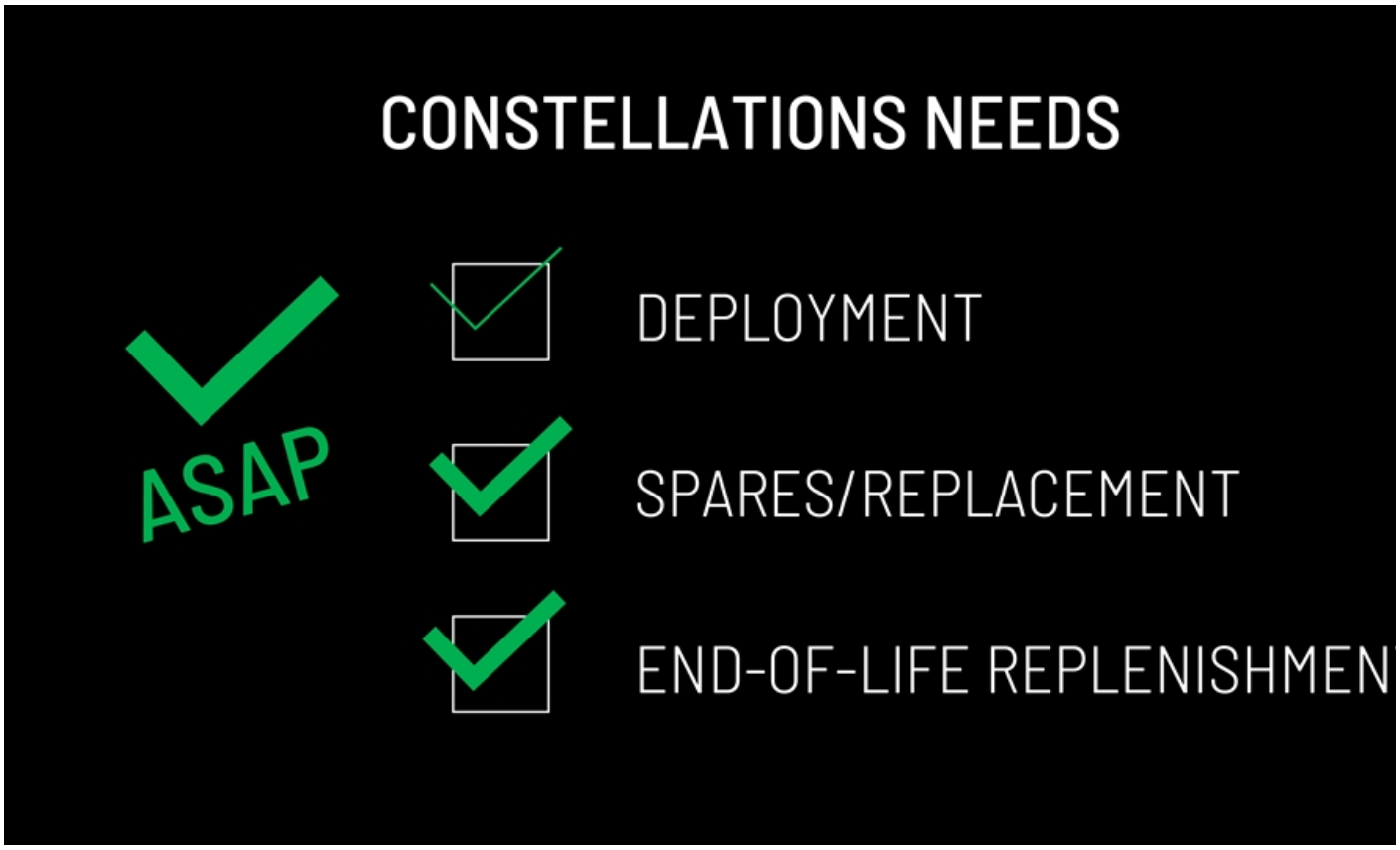

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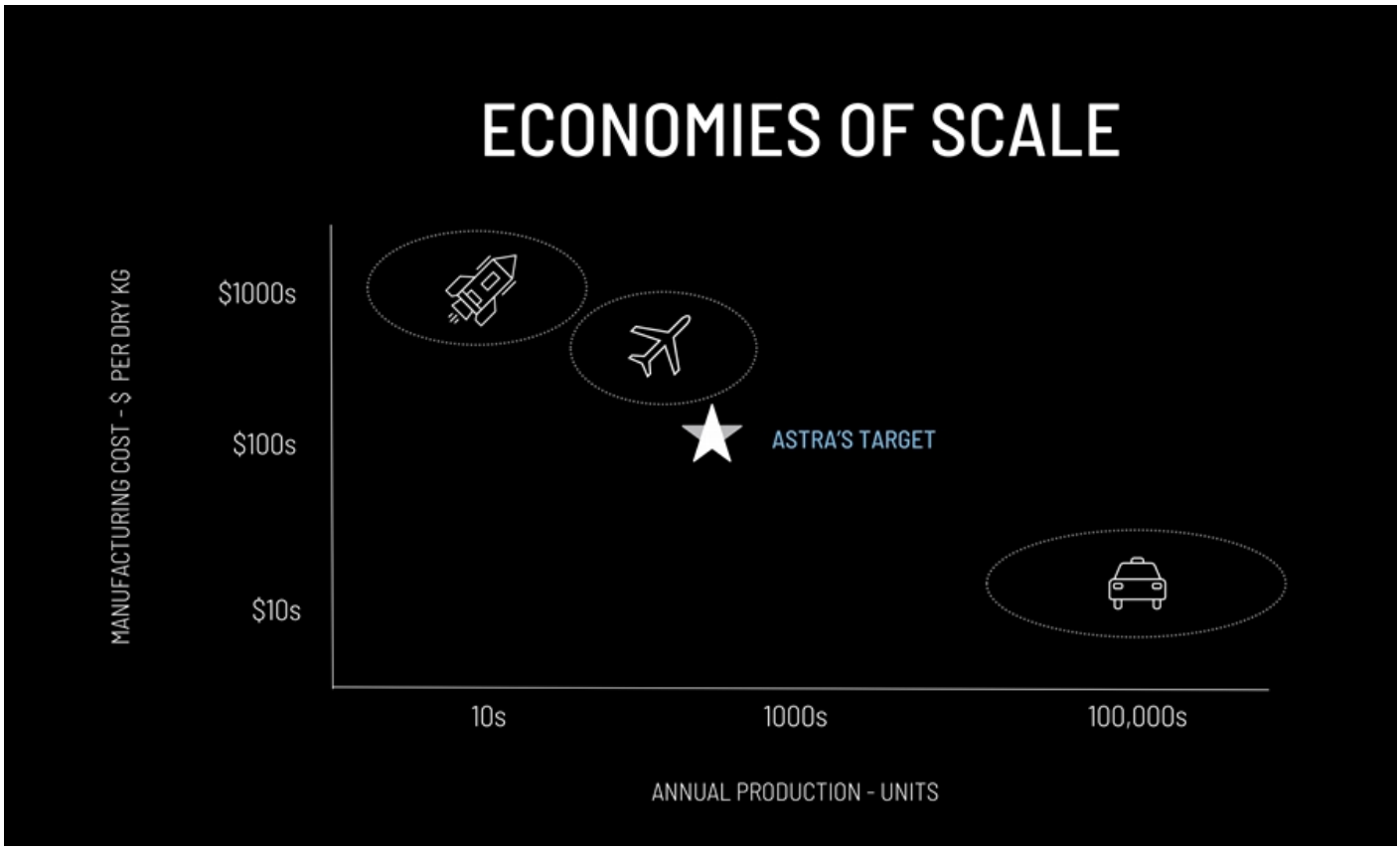

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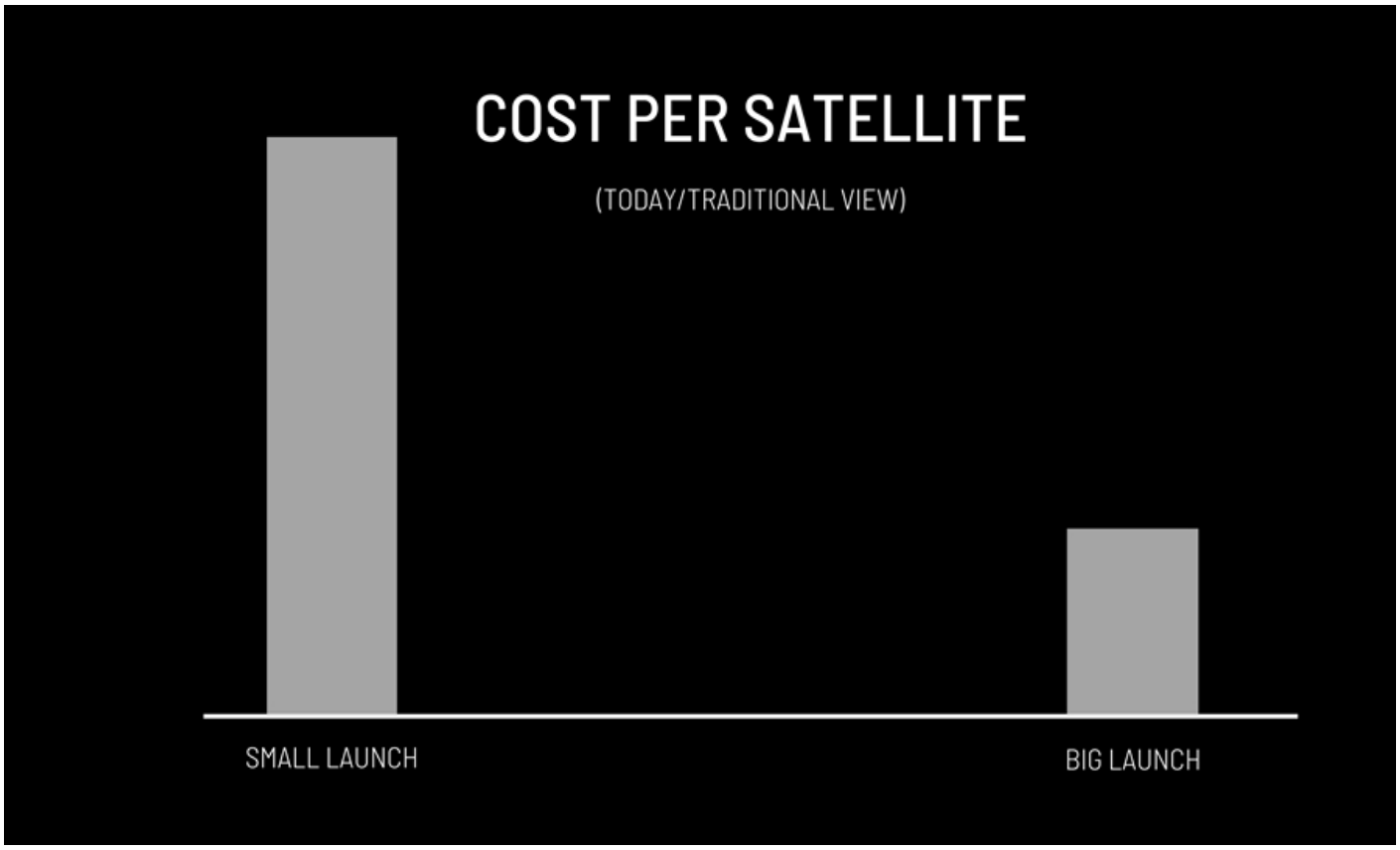

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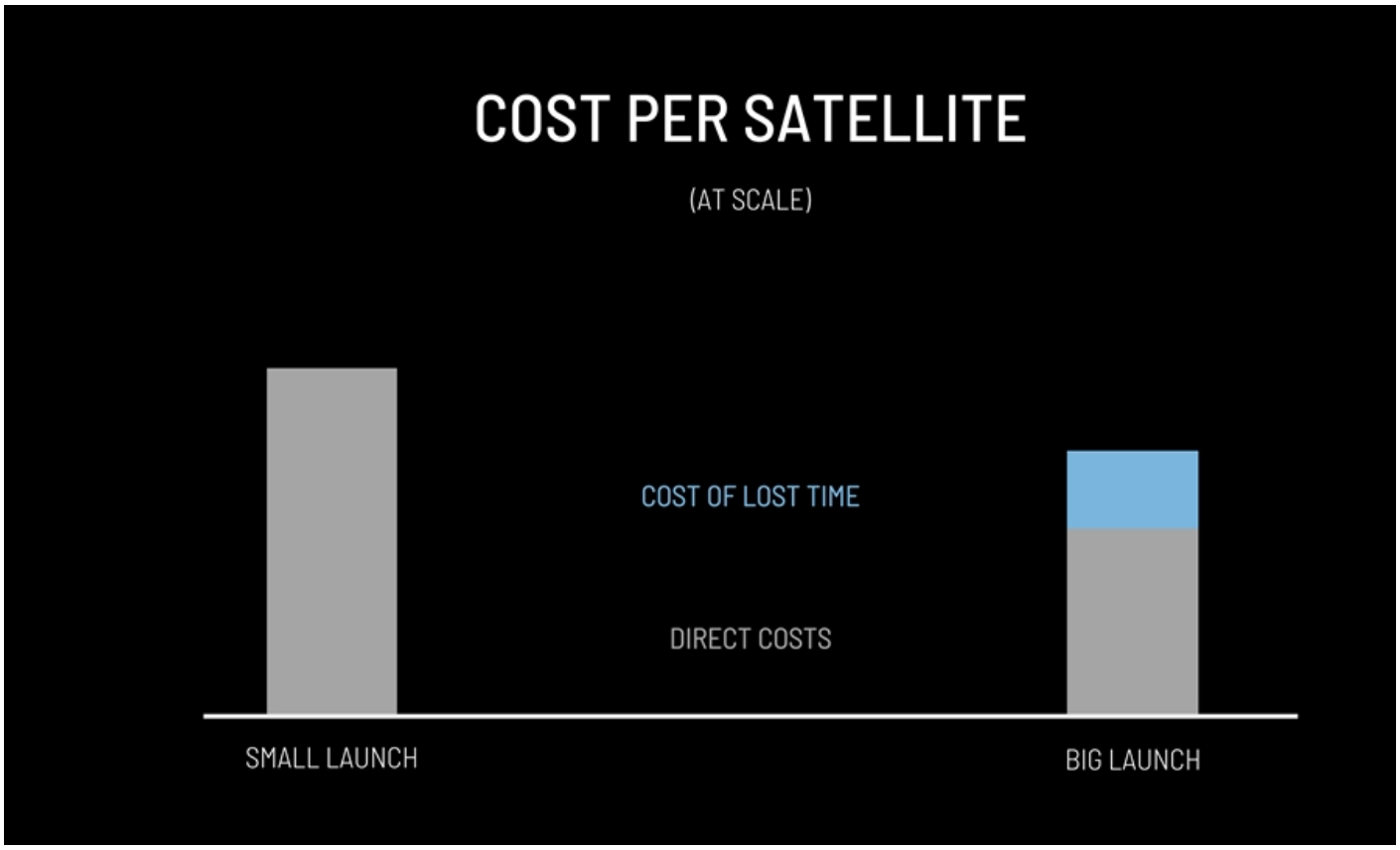

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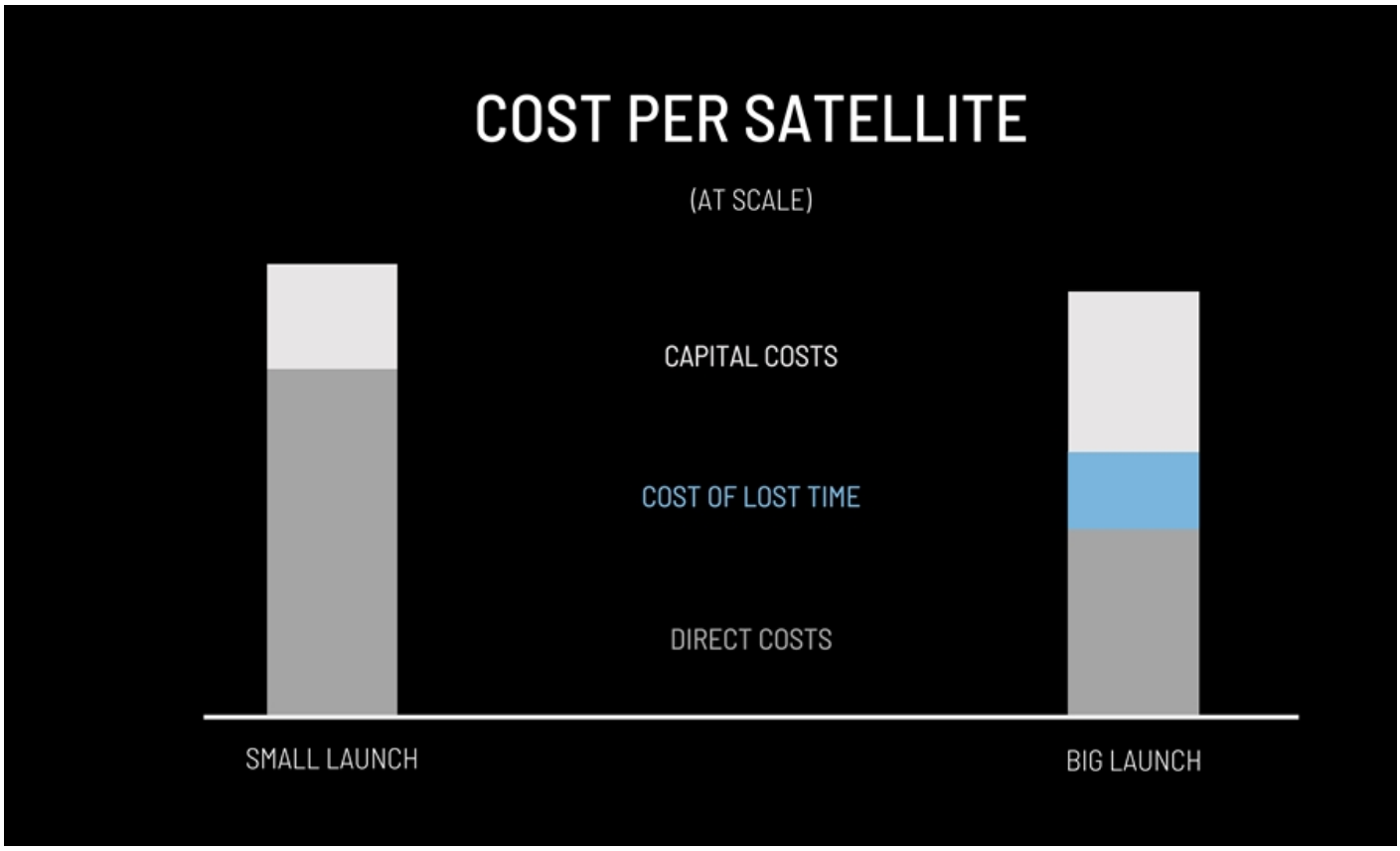

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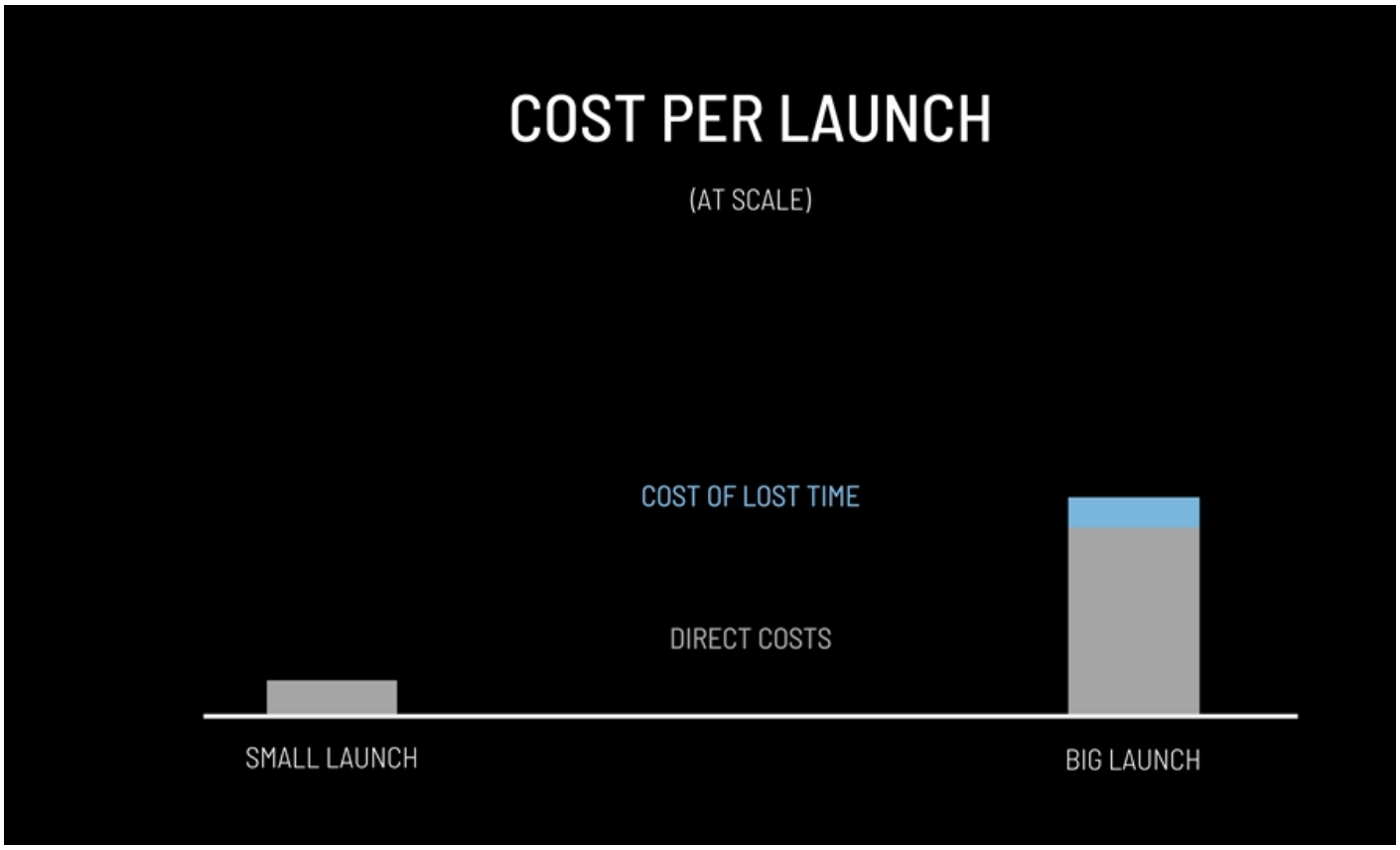

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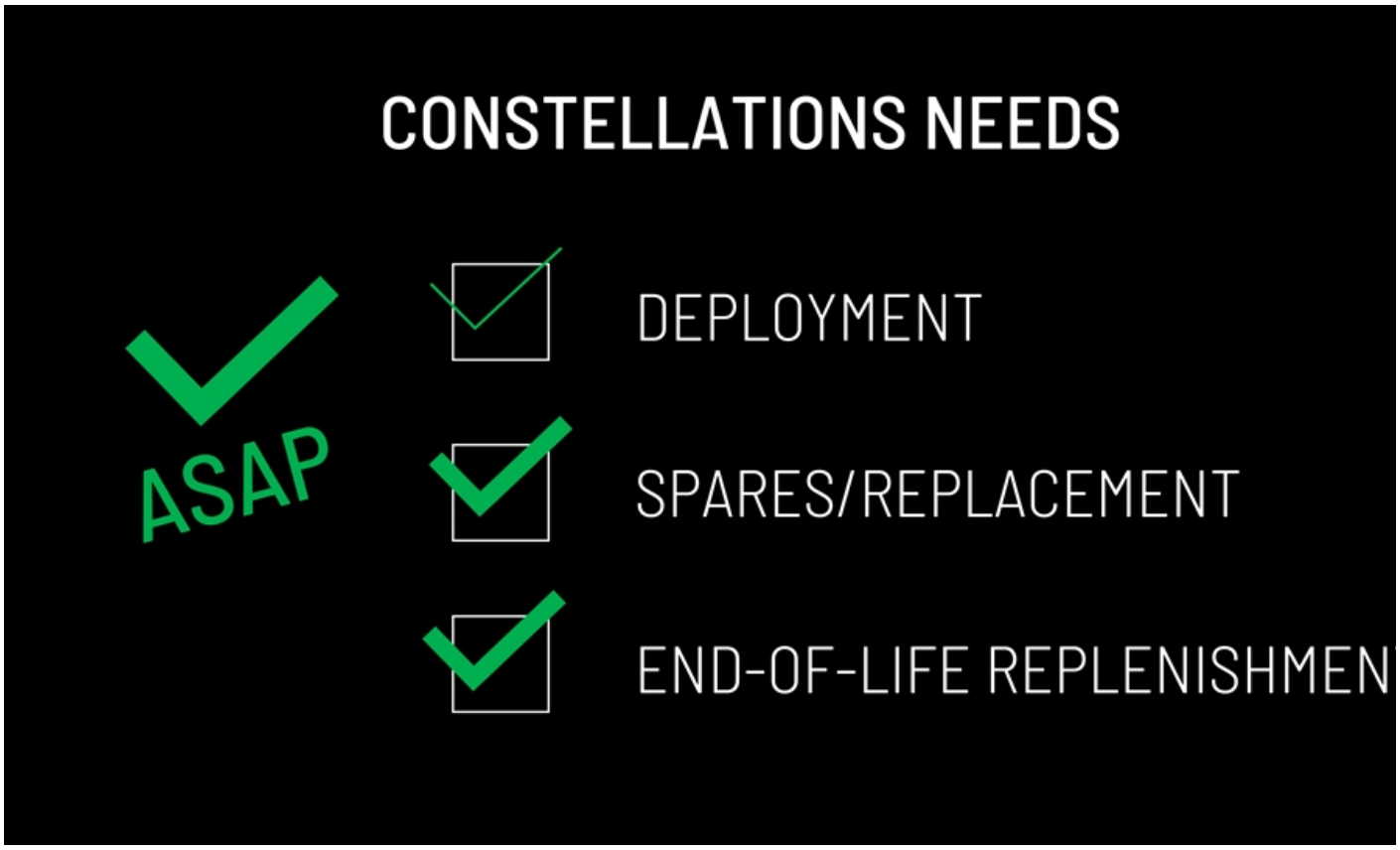

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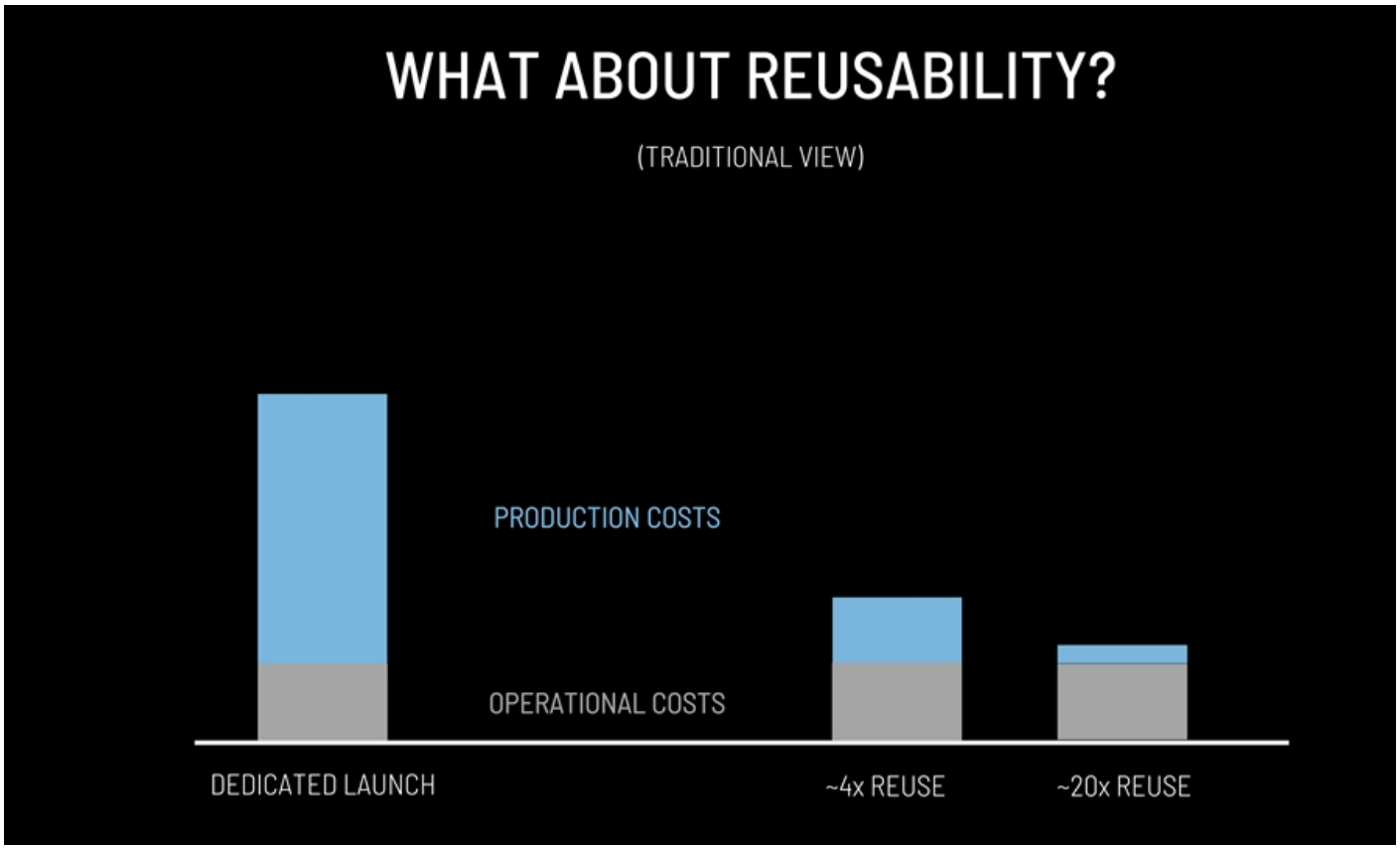

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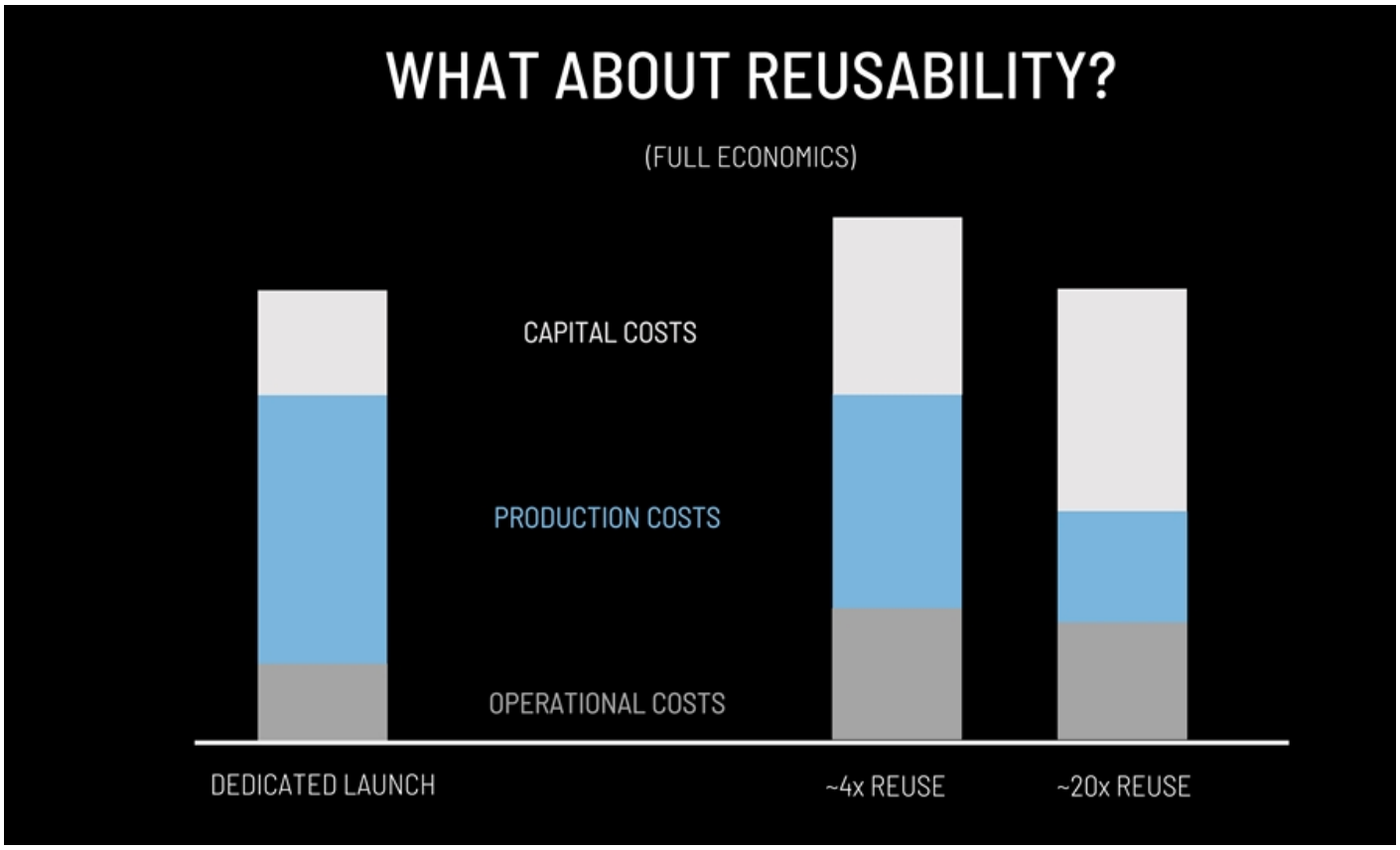

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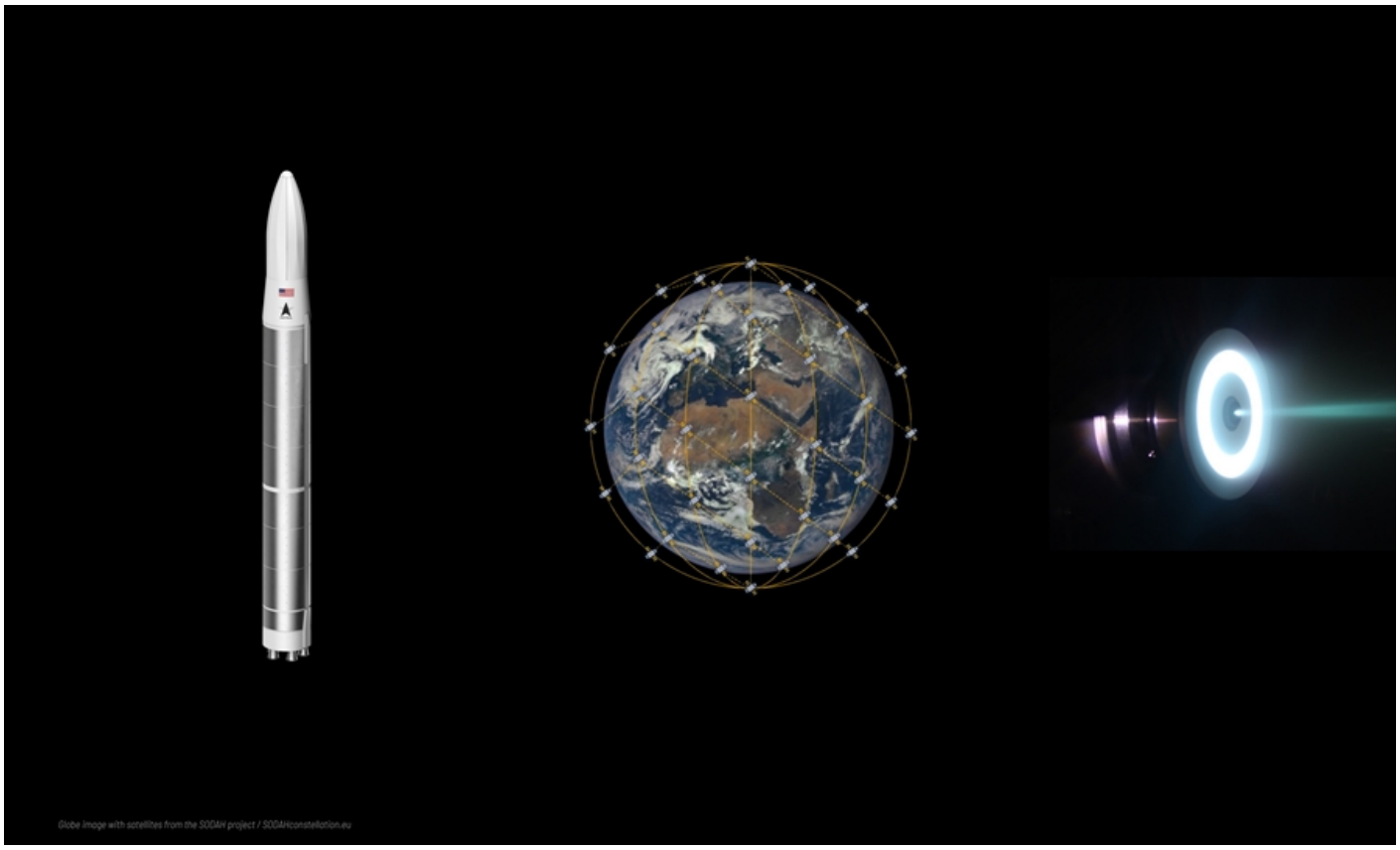

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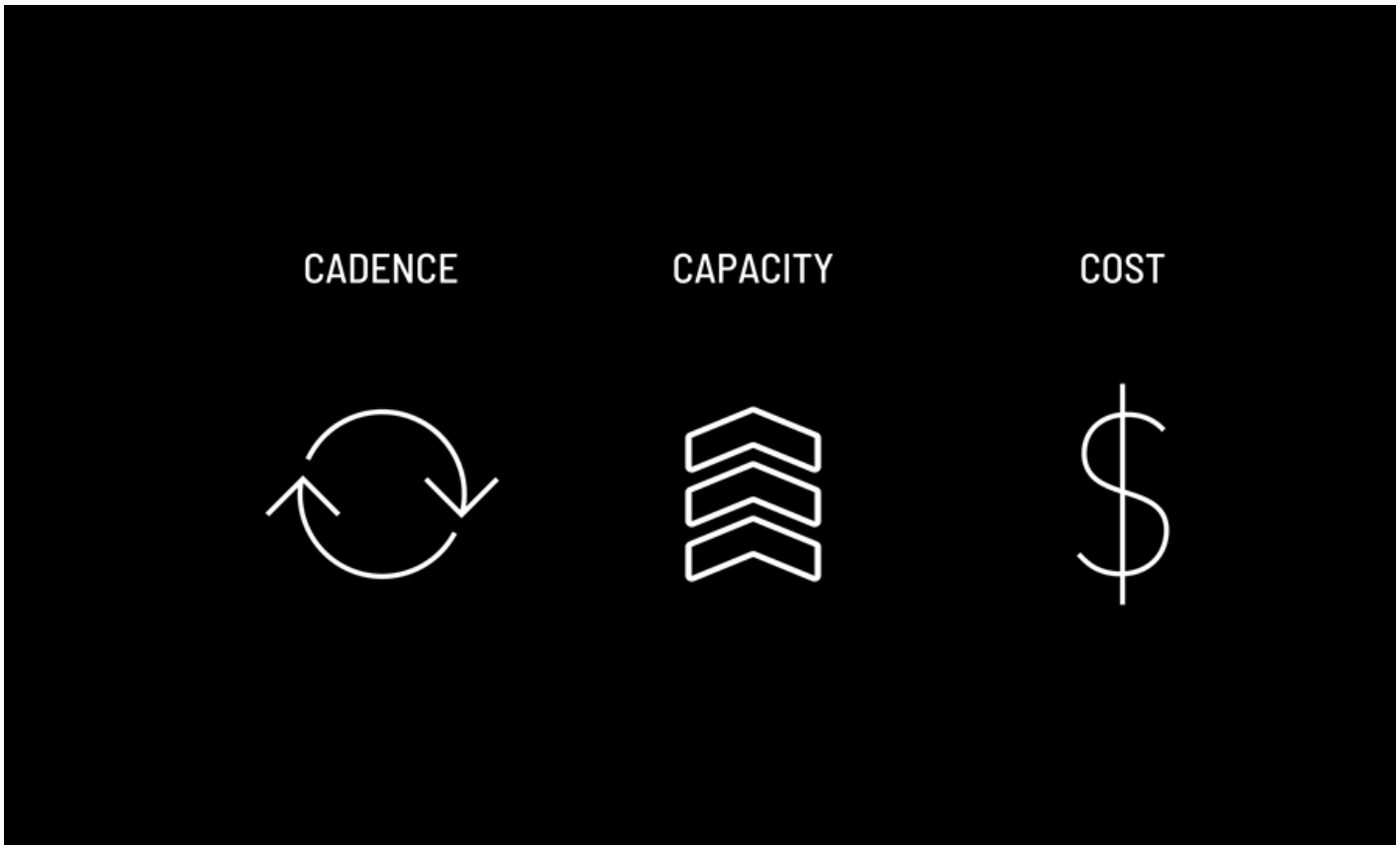

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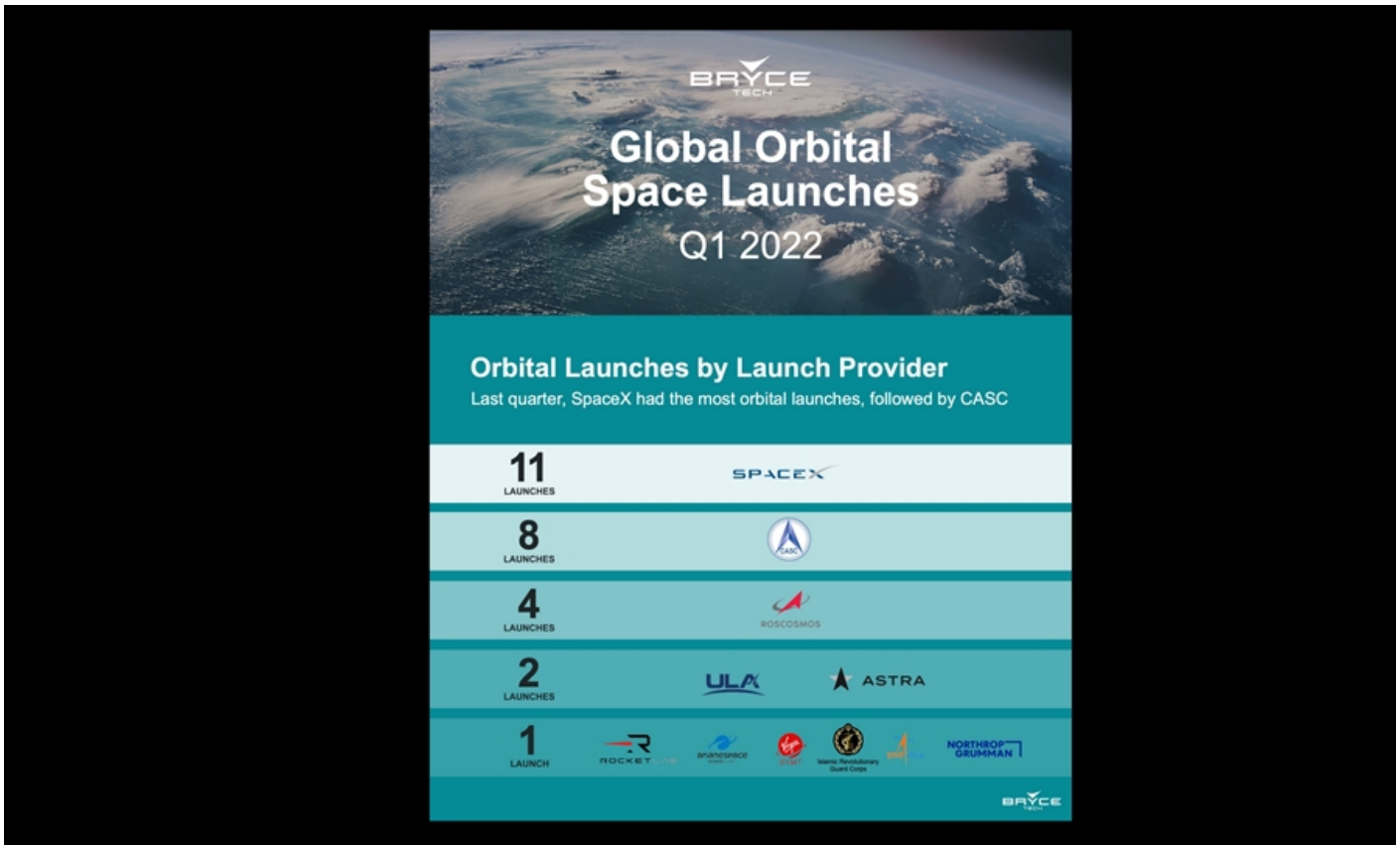

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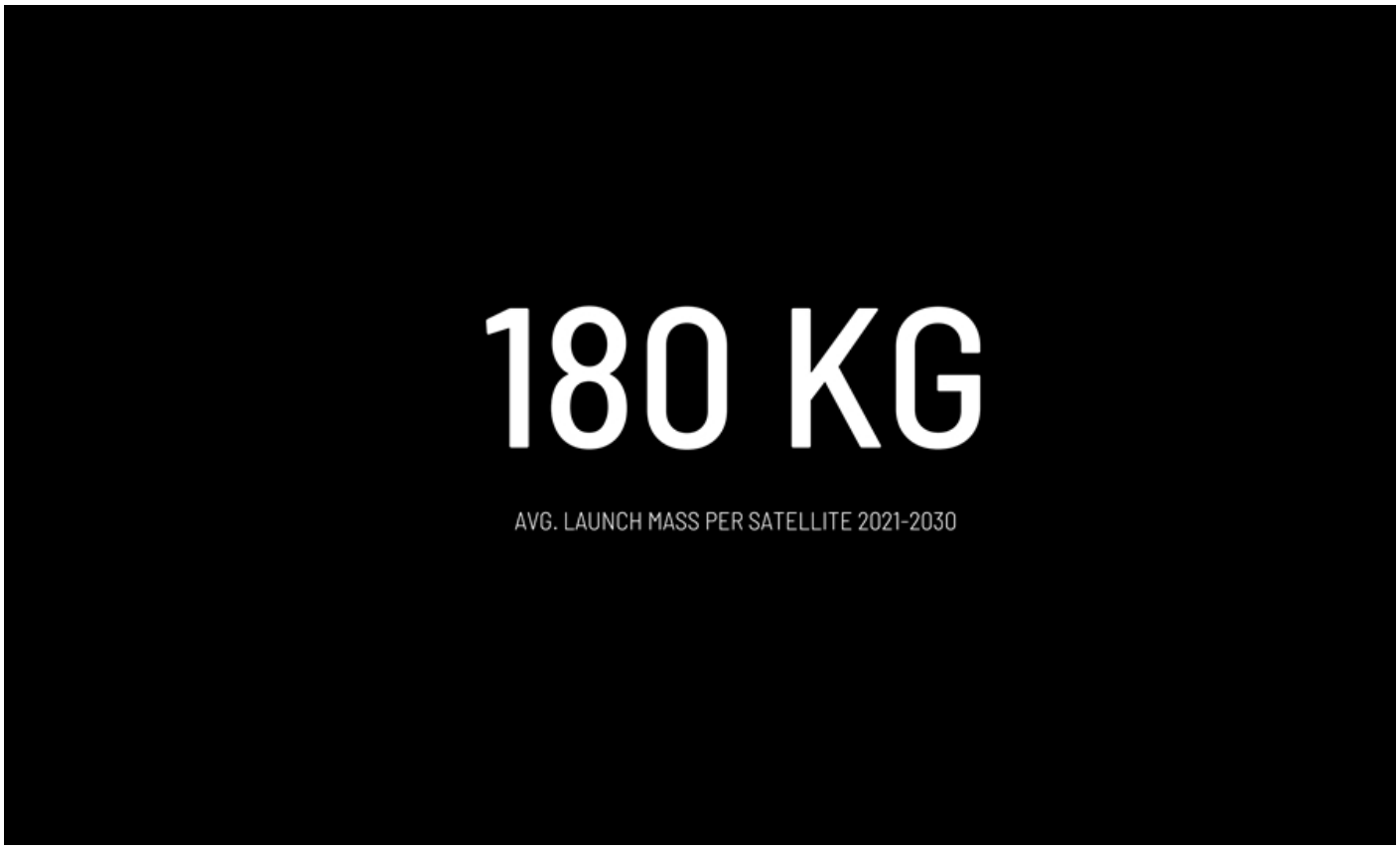

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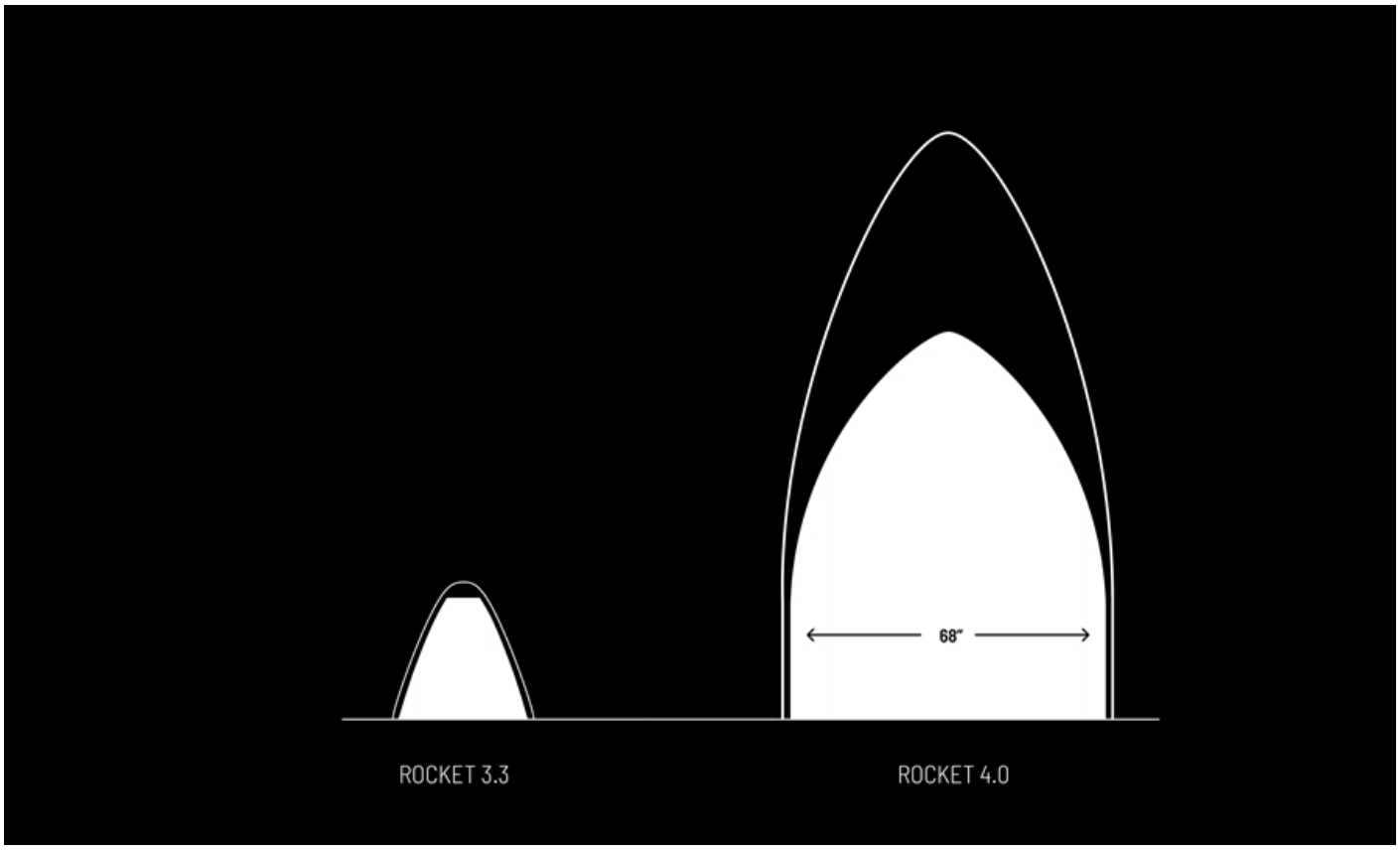

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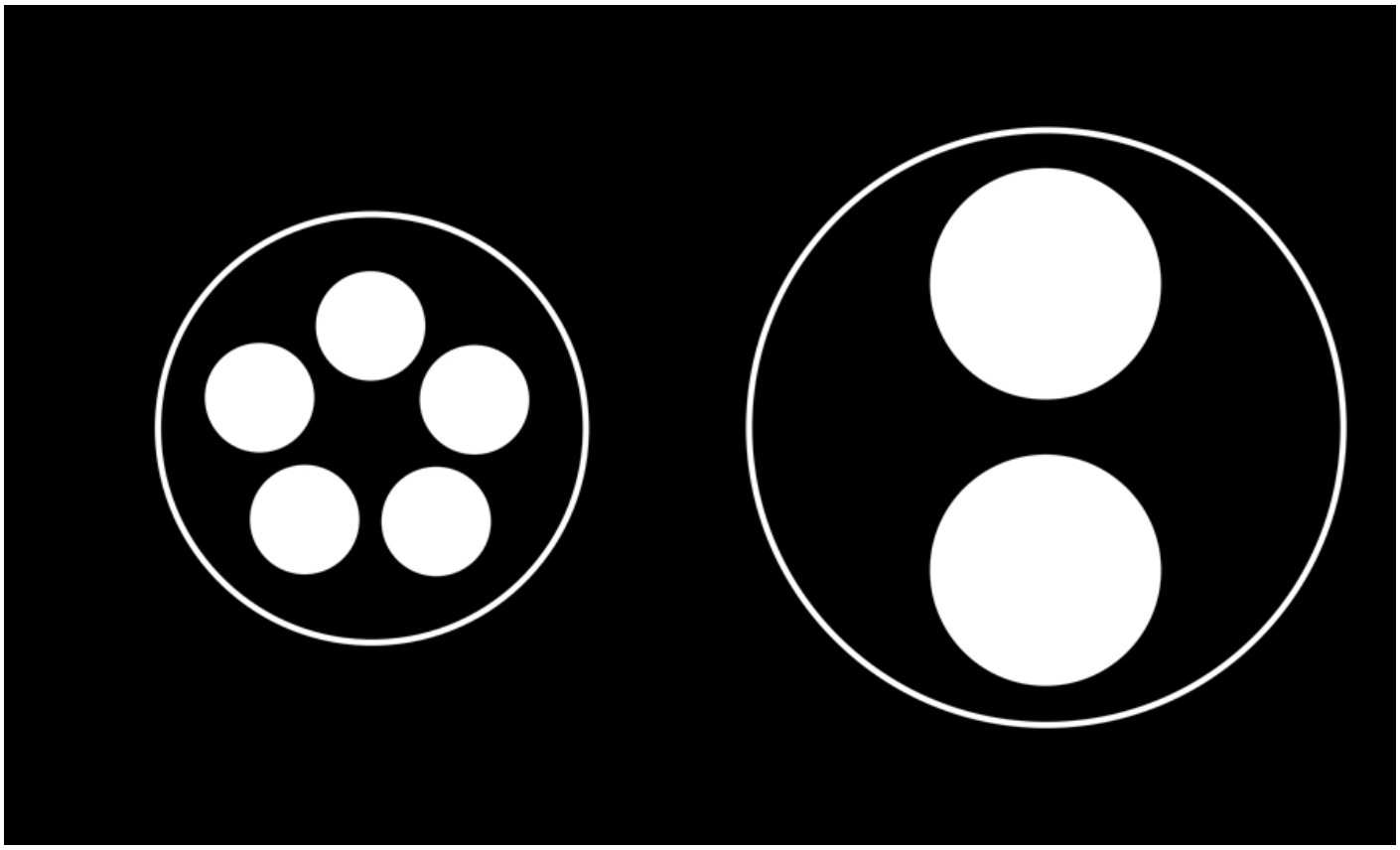


$ 3.95M - BASE LAUNCH PRICE

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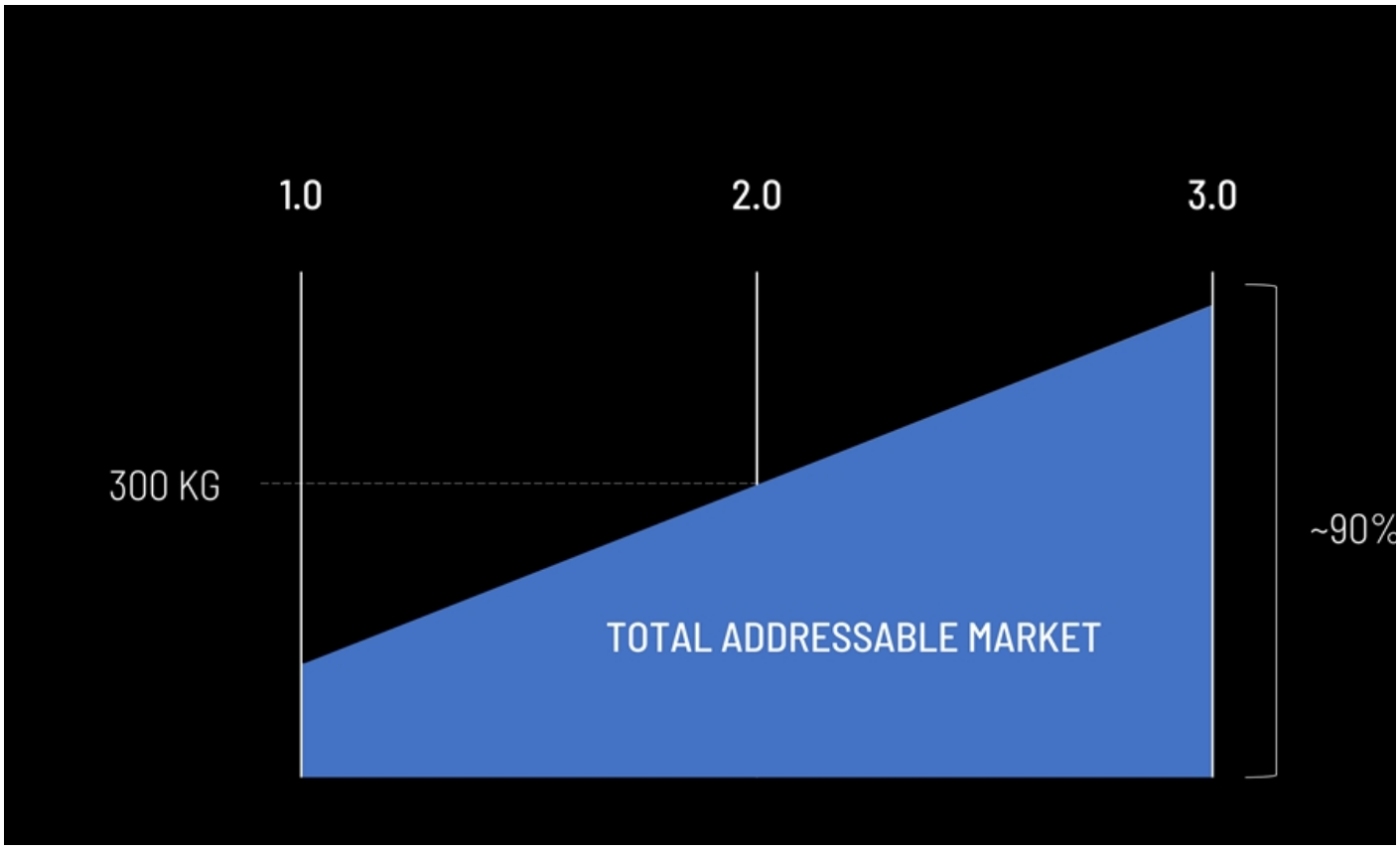

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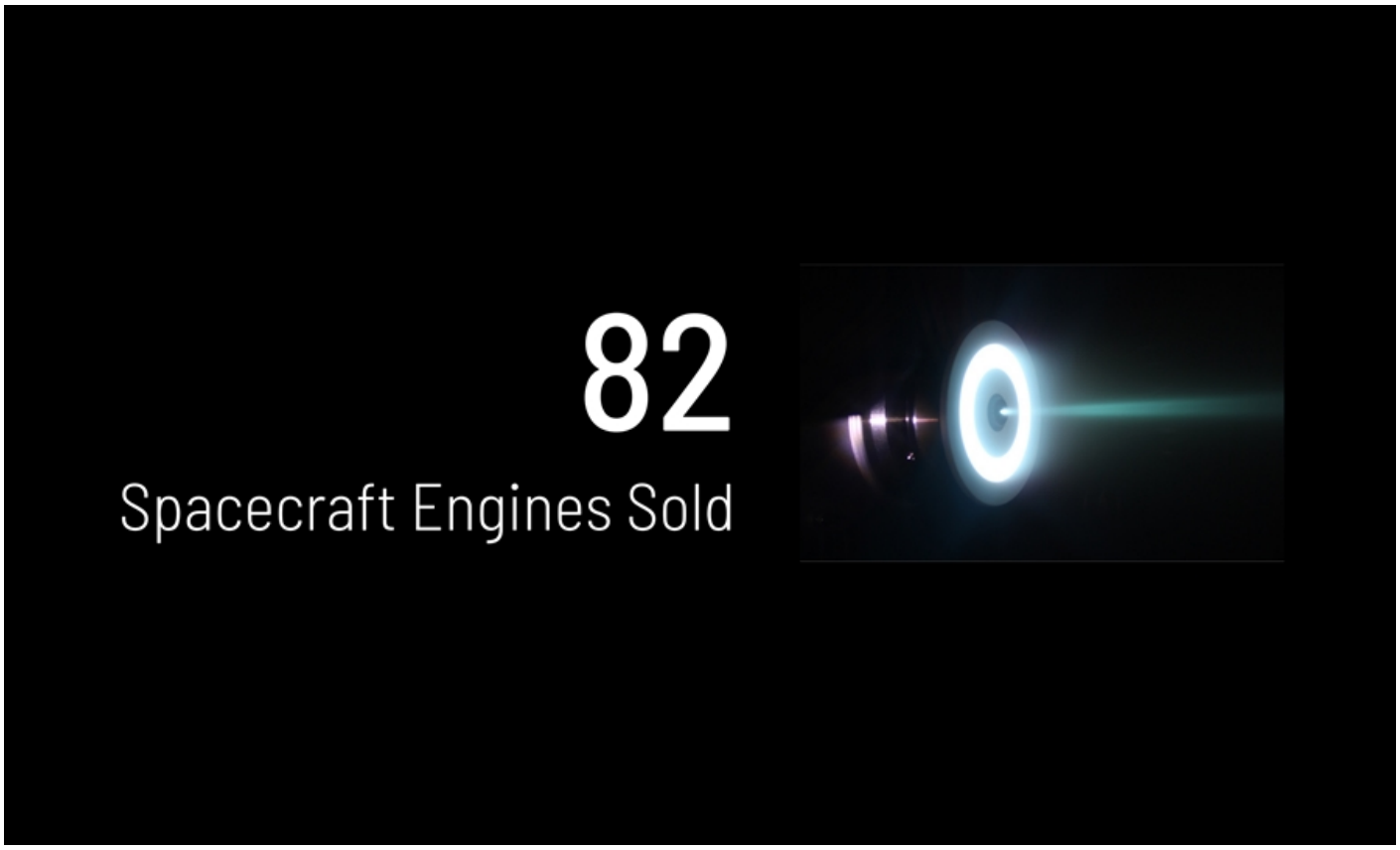

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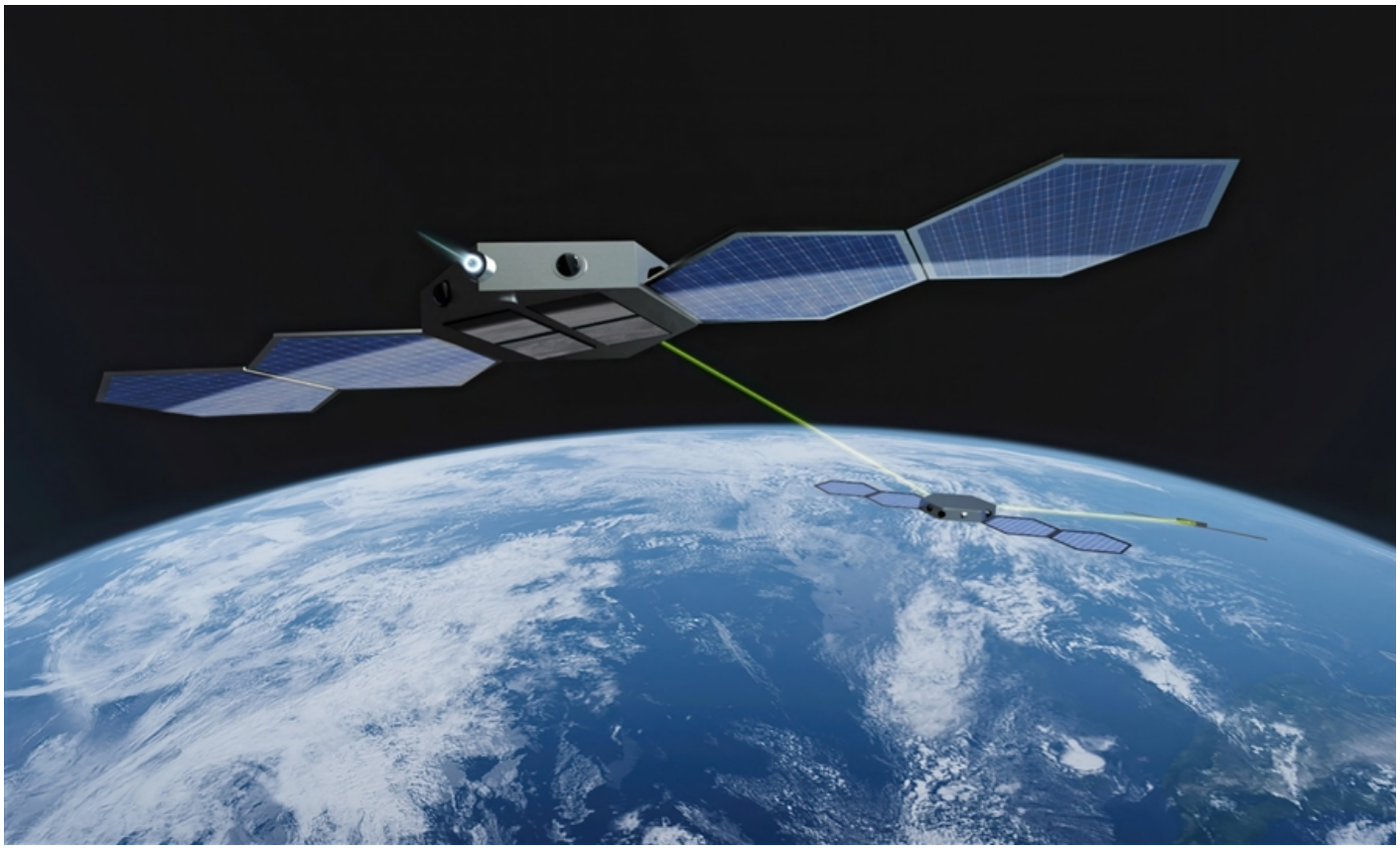

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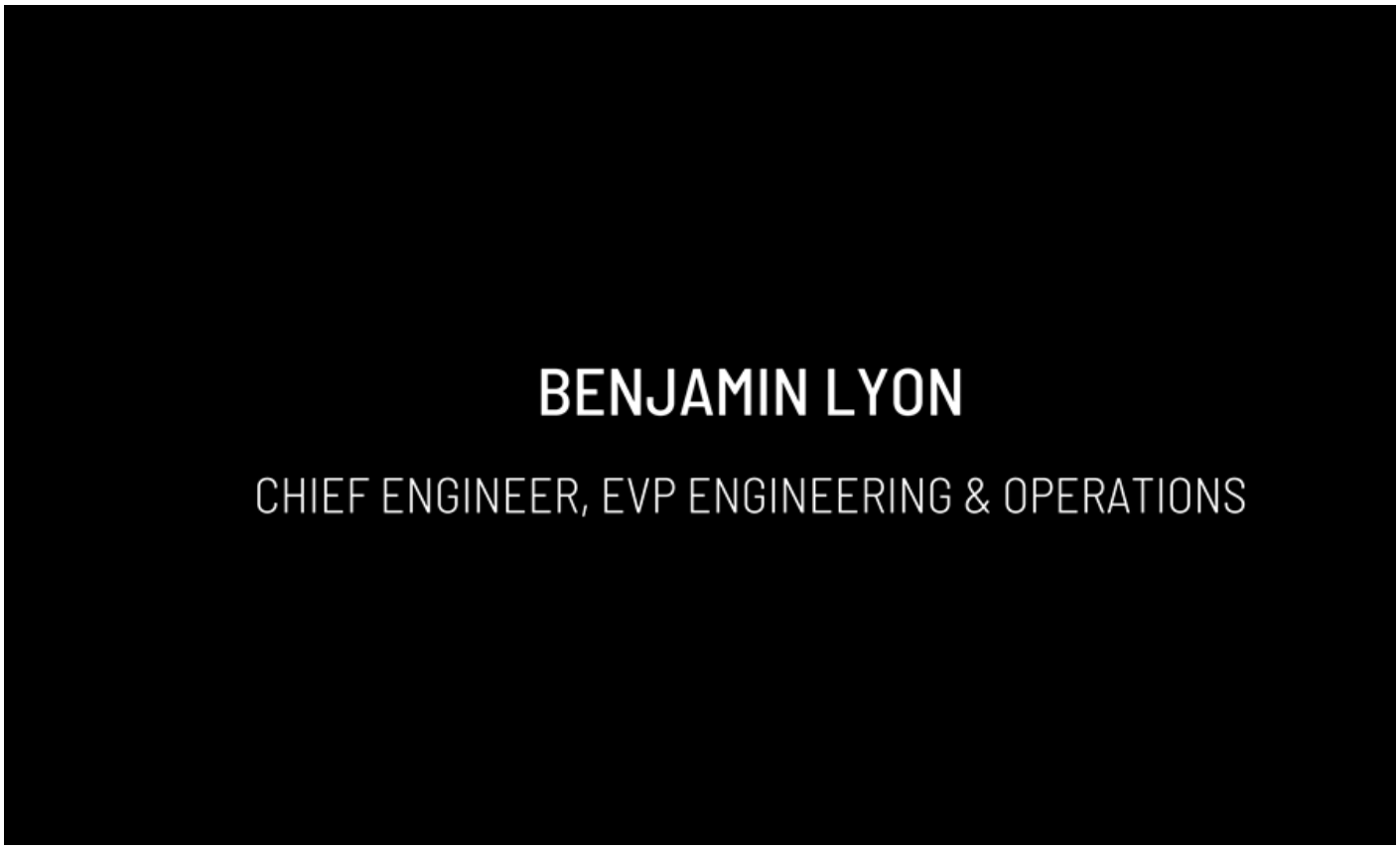

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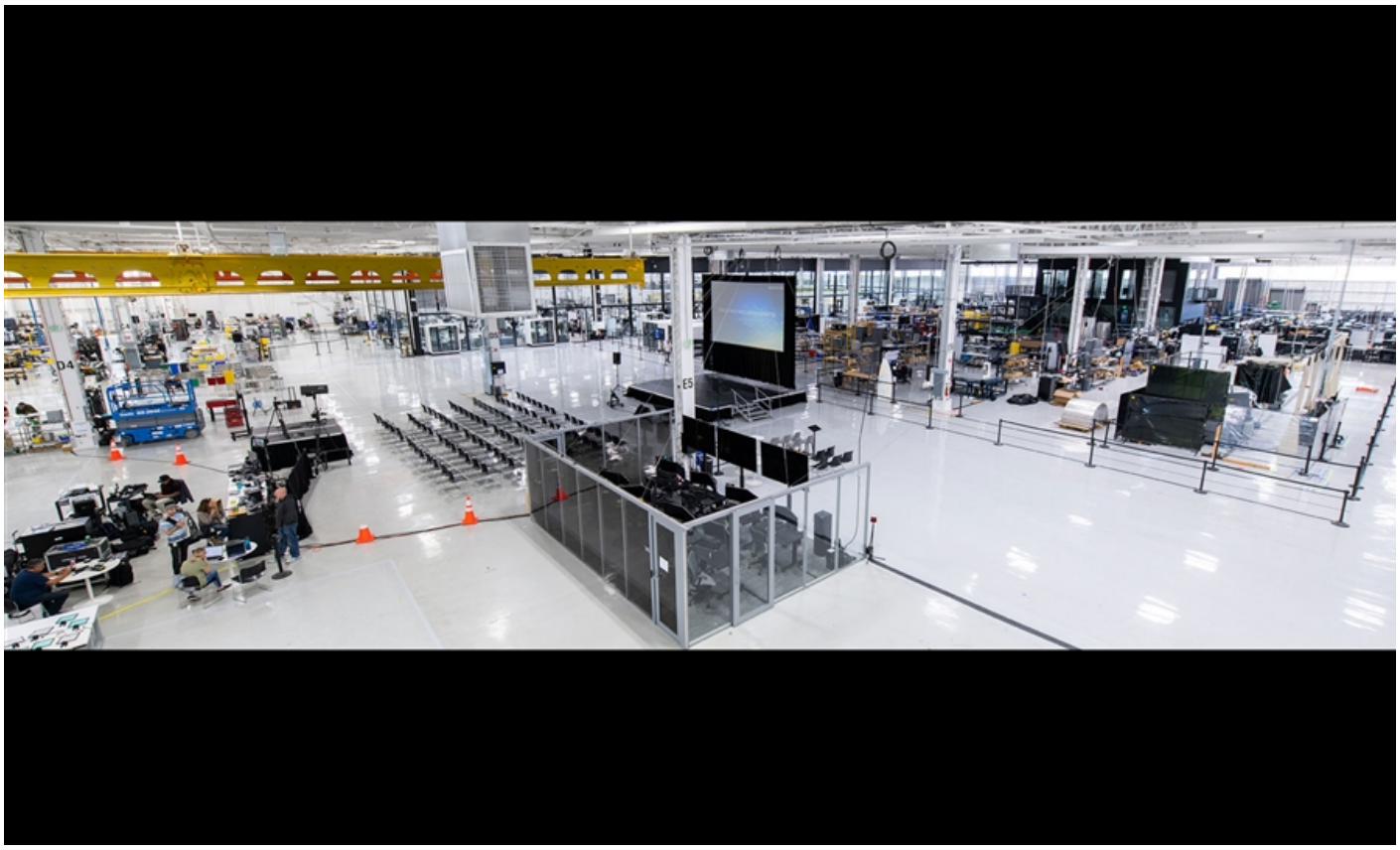

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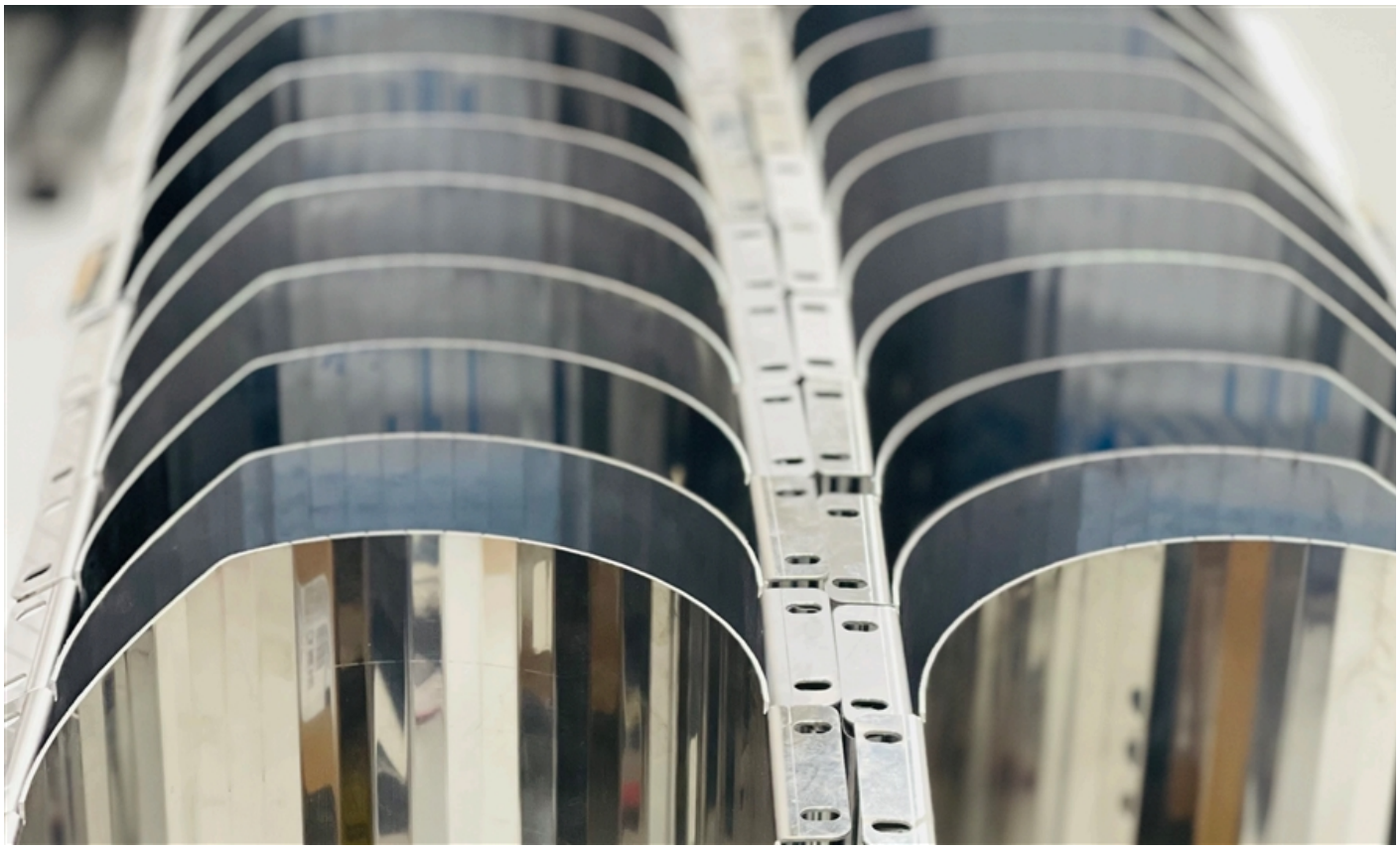

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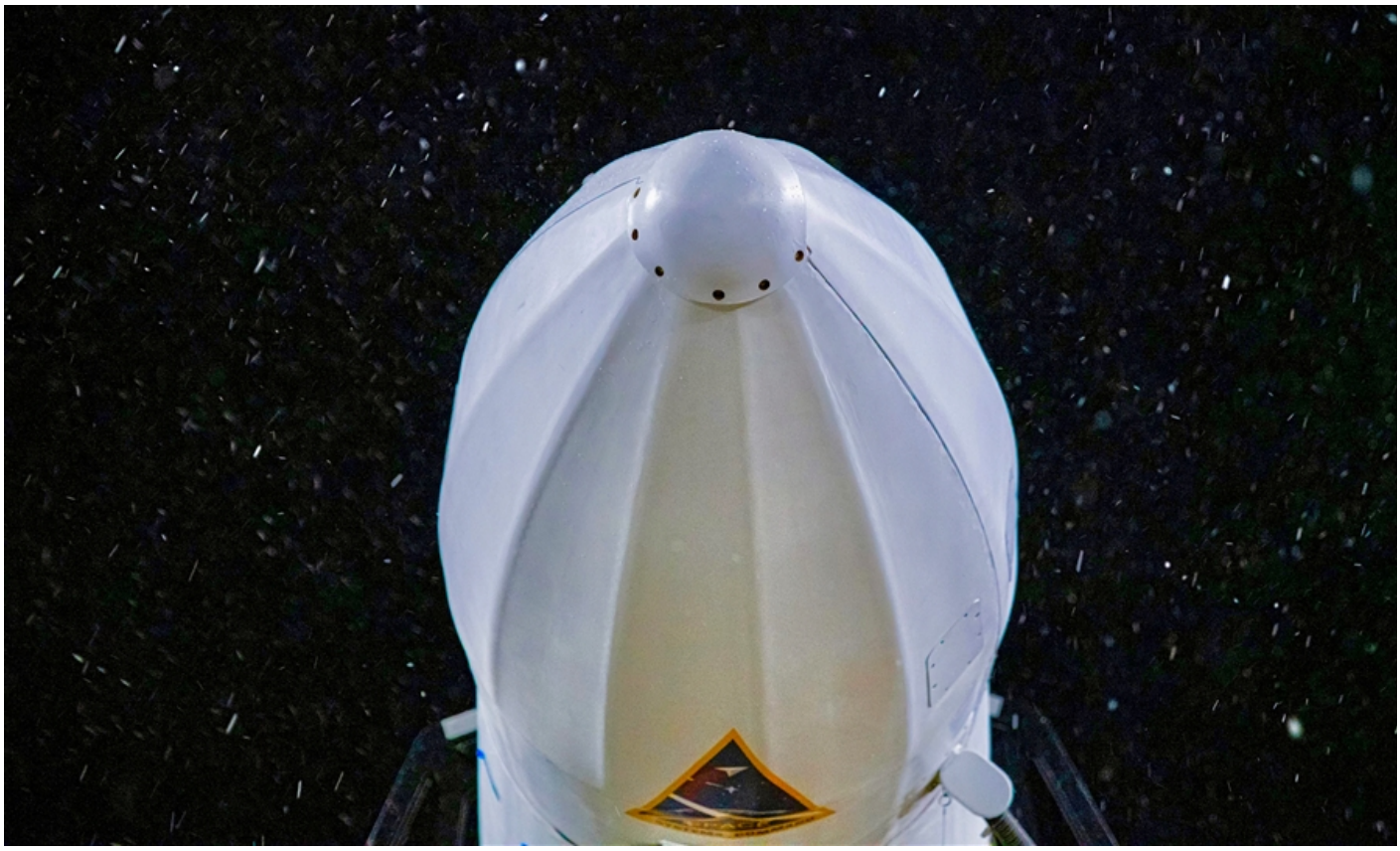

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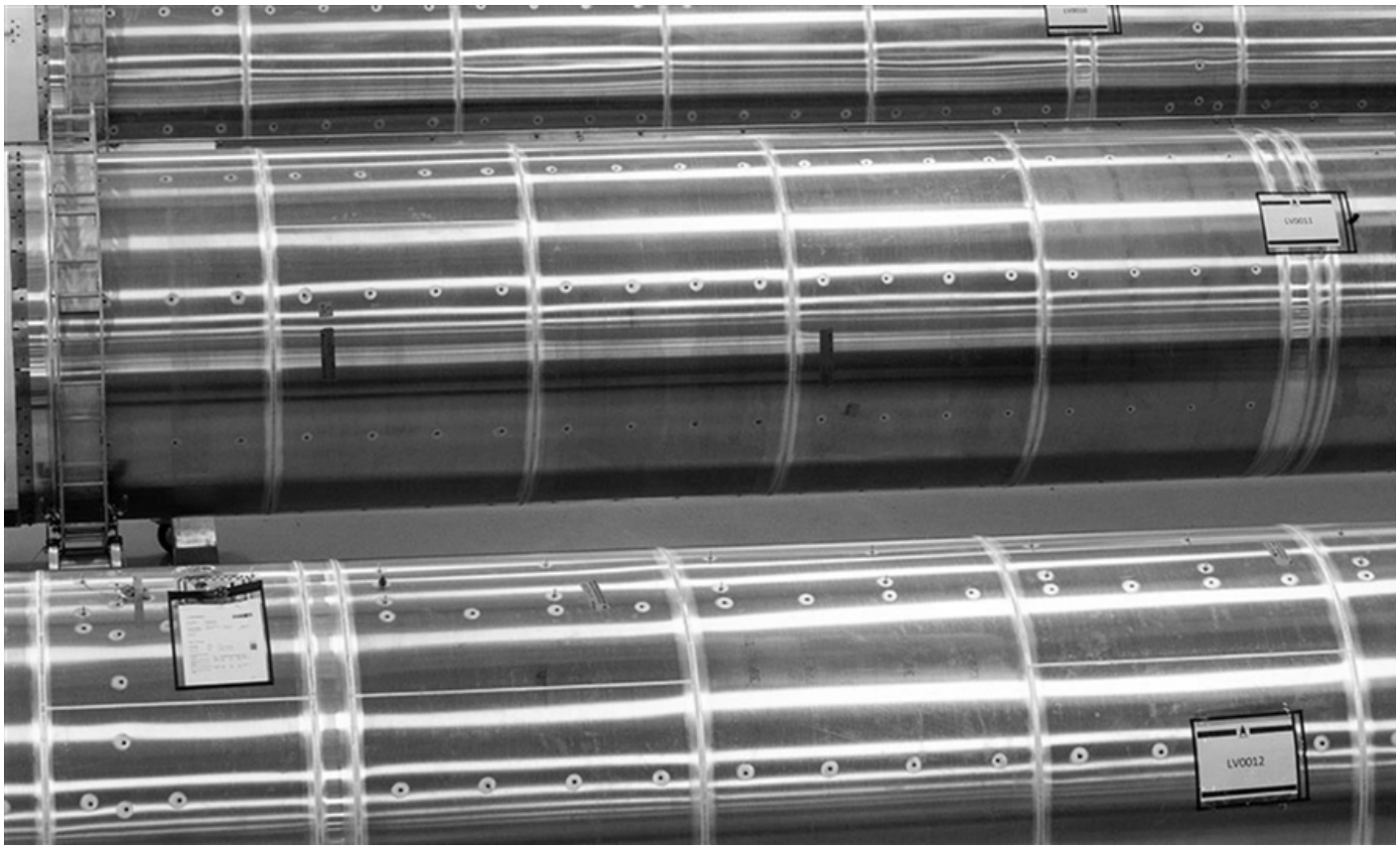

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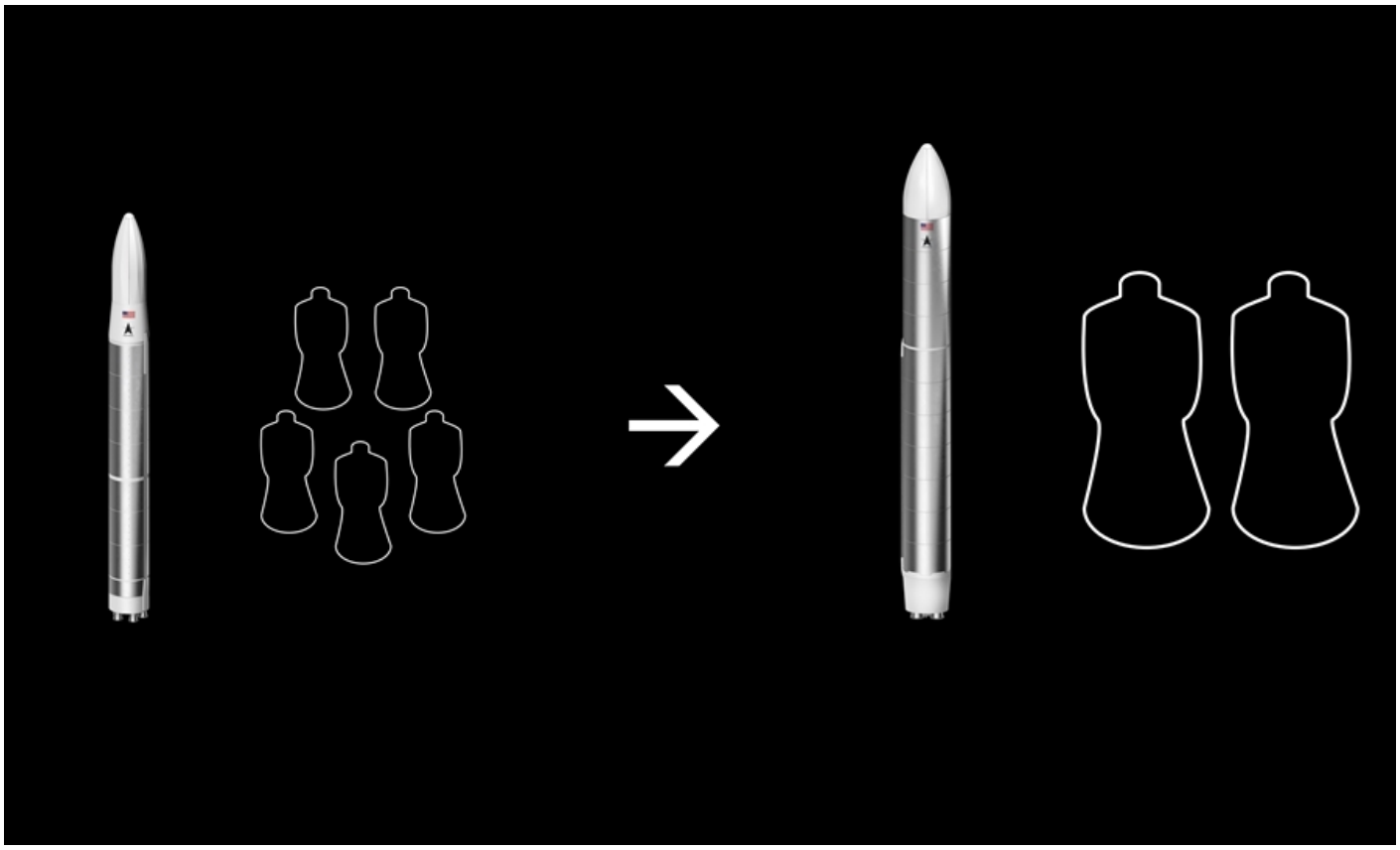

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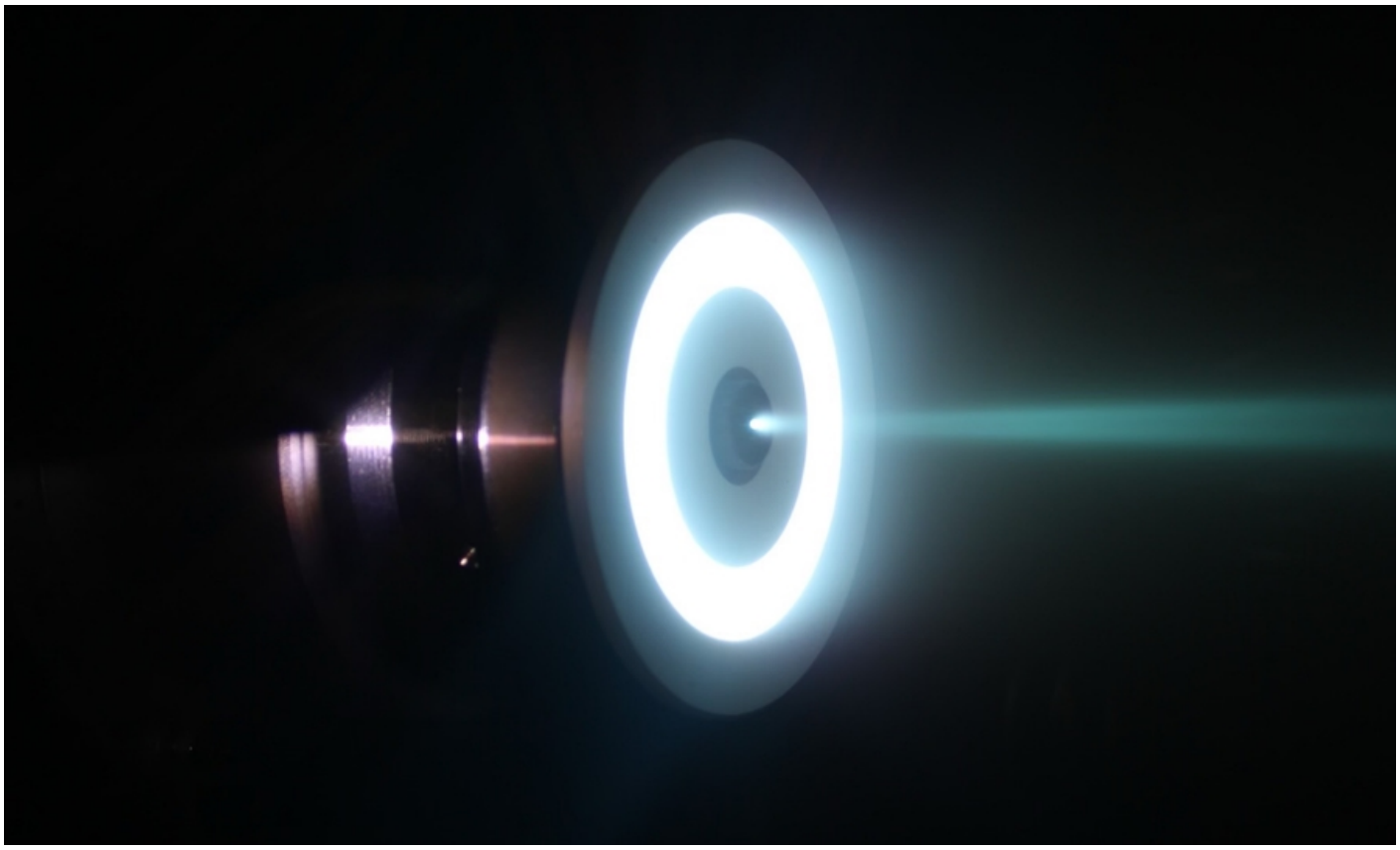

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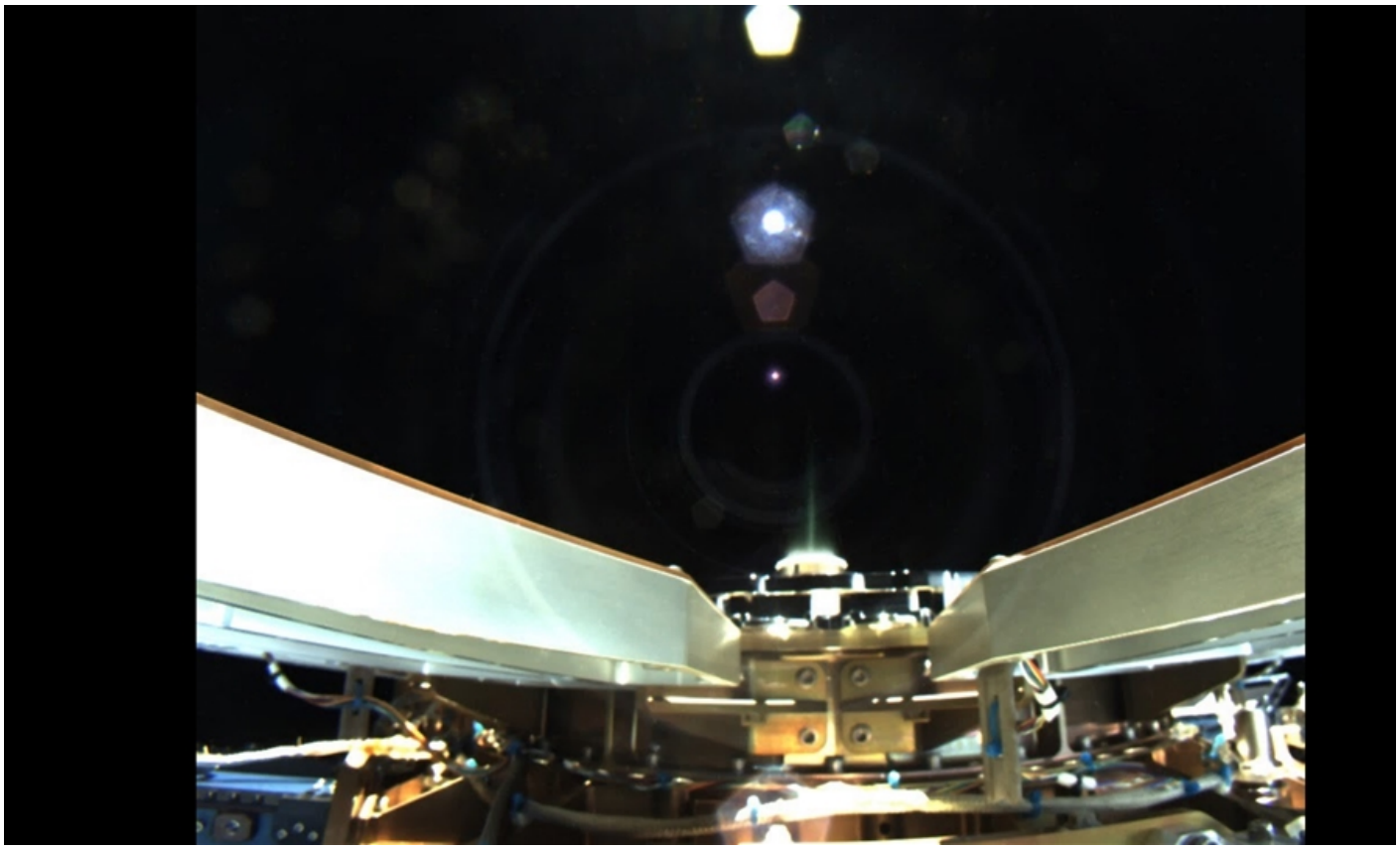

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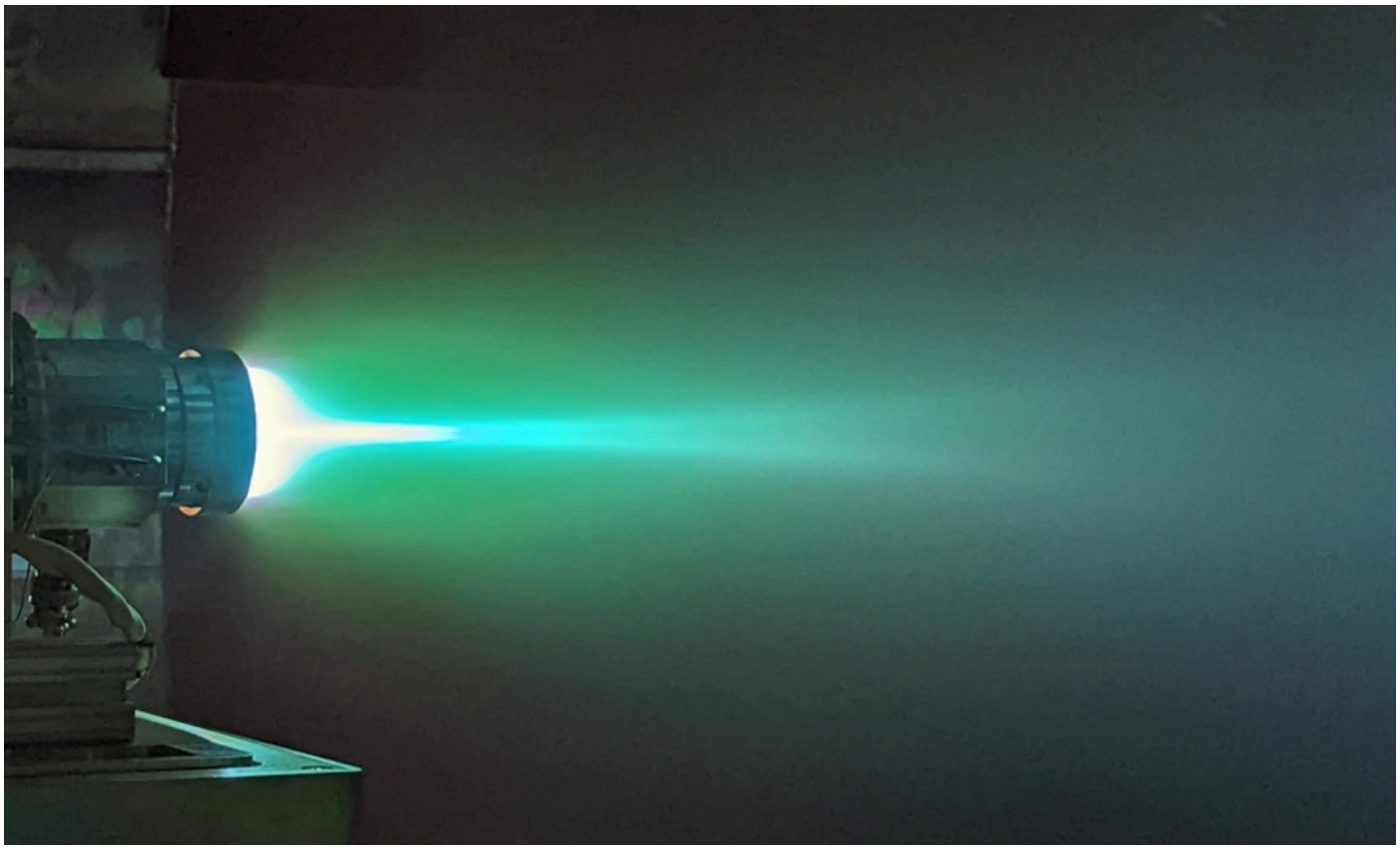

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MARTIN ATTIQ
CHIEF BUSINESS OFFICER

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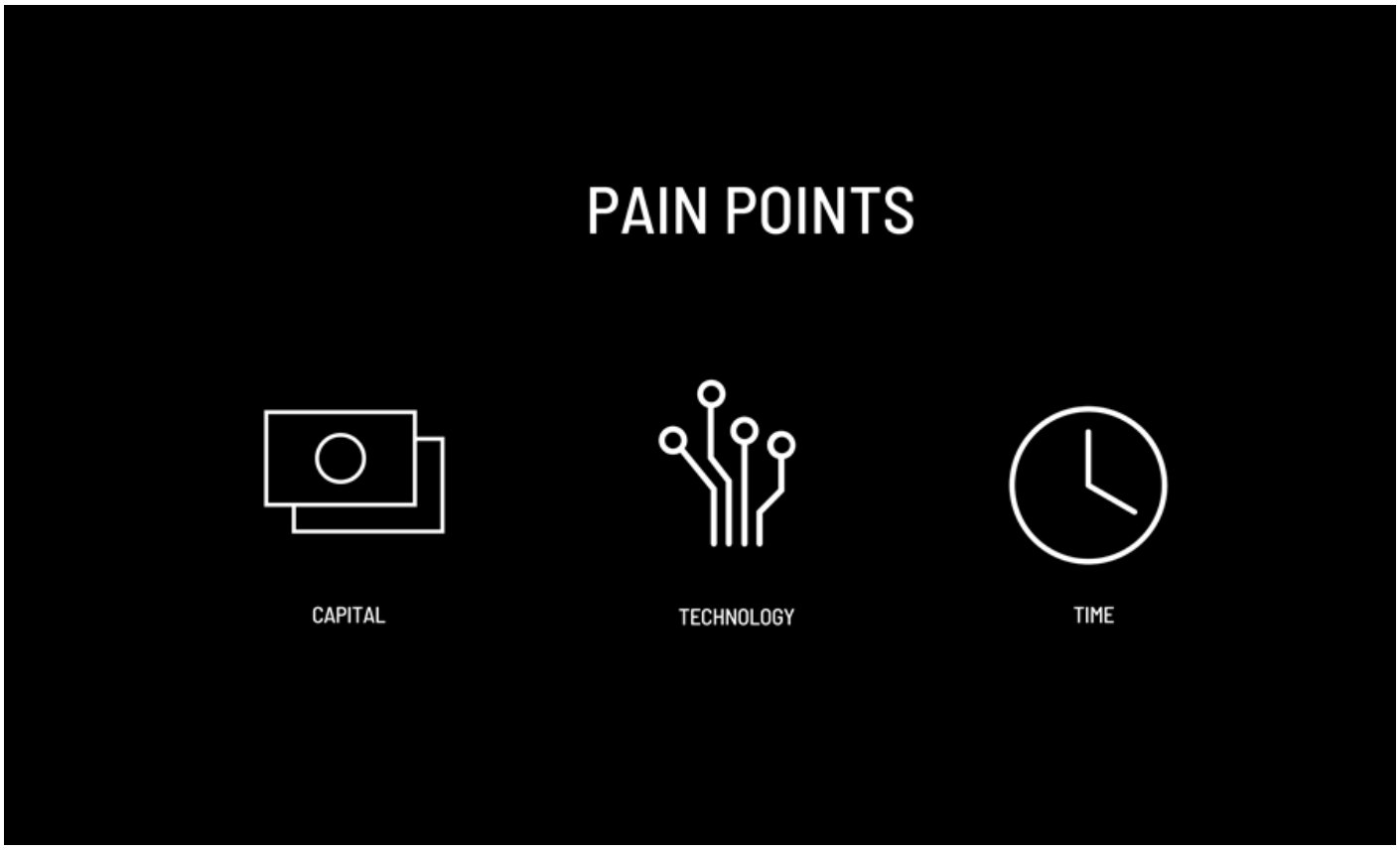

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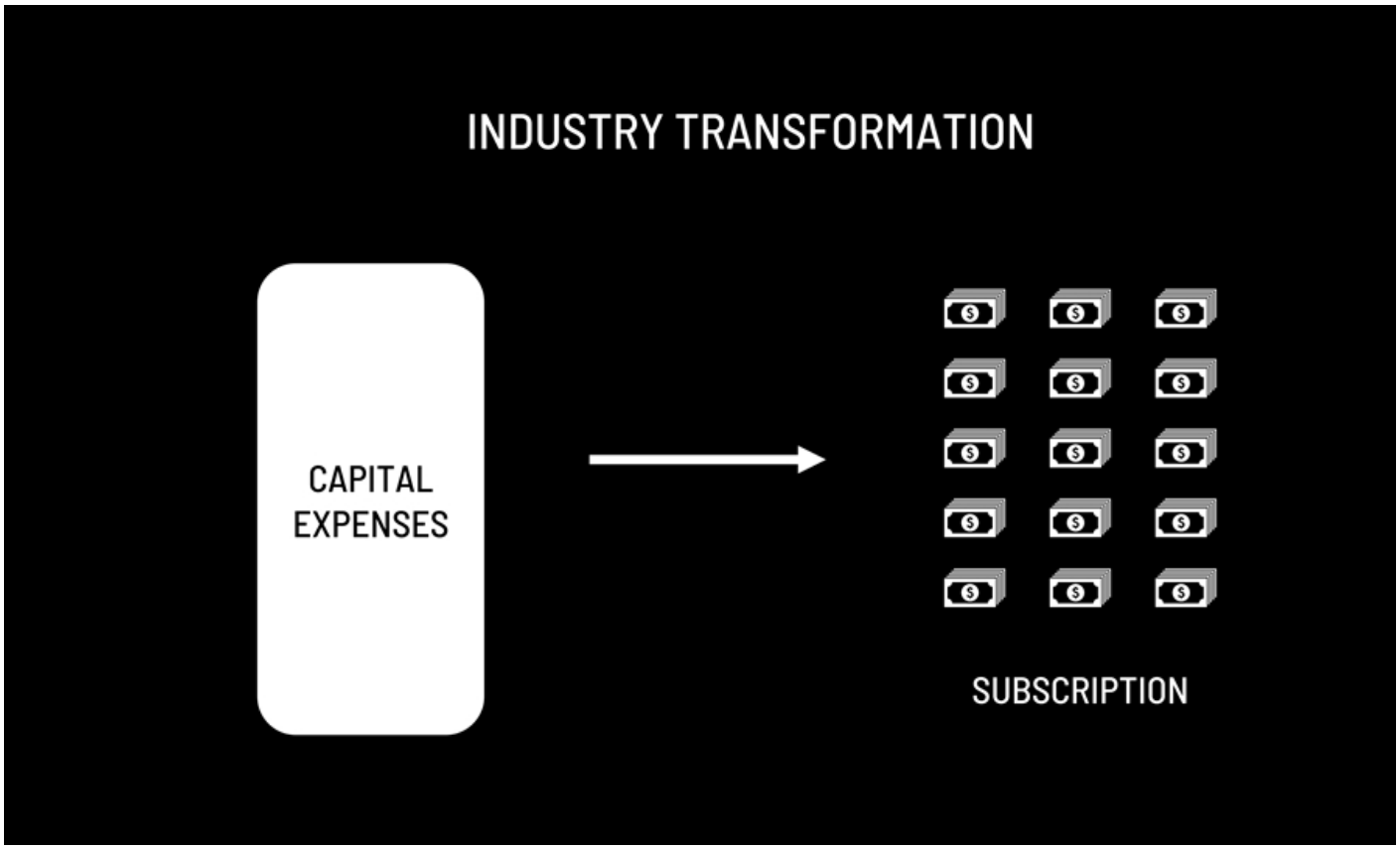

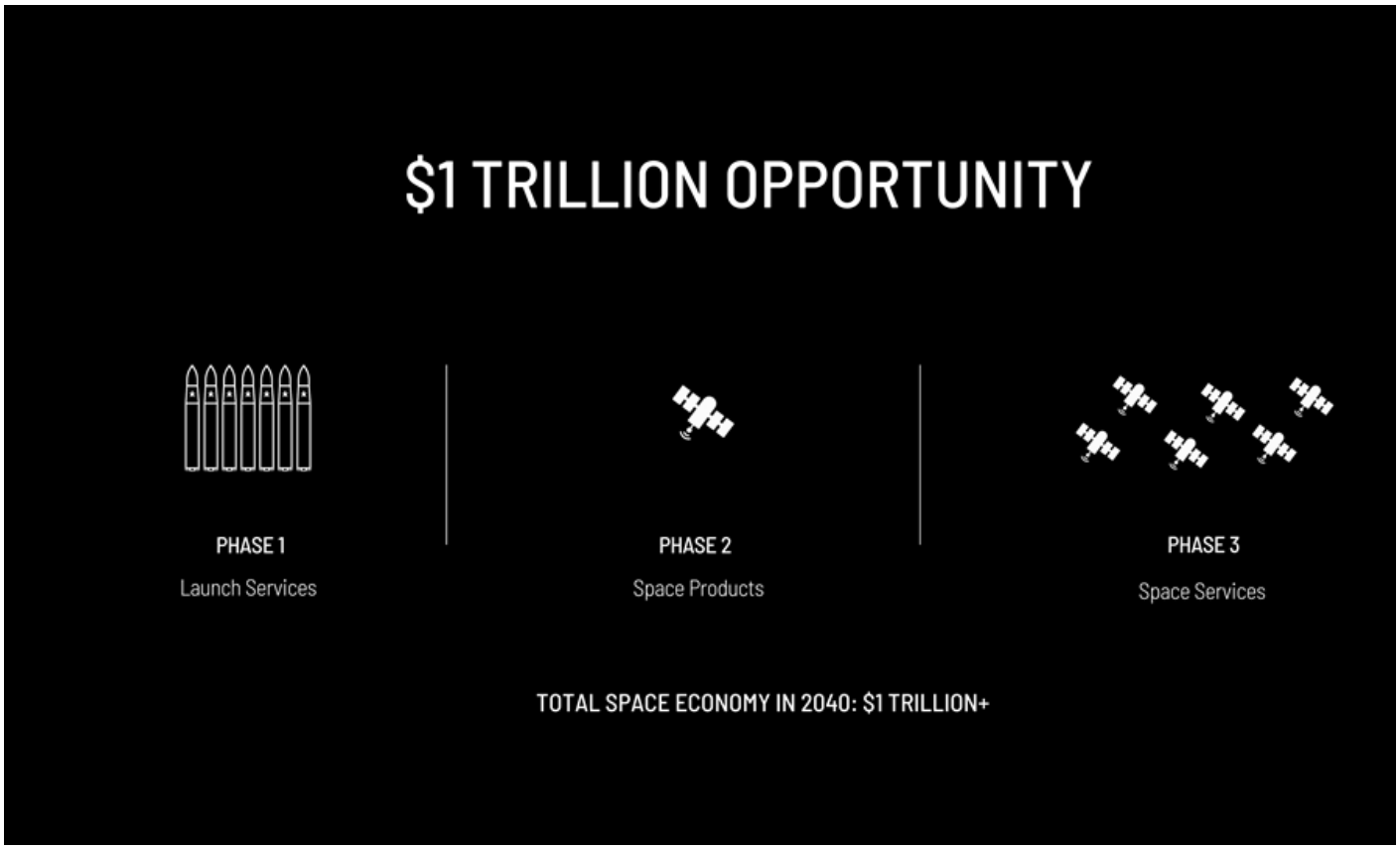
$1 TRILLION OPPORTUNITY
PHASE 1
Launch Services
PHASE 2
Space Products
PHASE 3
Space Services
TOTAL SPACE ECONOMY IN 2040: $1 TRILLION+


KELYN BRANNON
CHIEF FINANCIAL OFFICER

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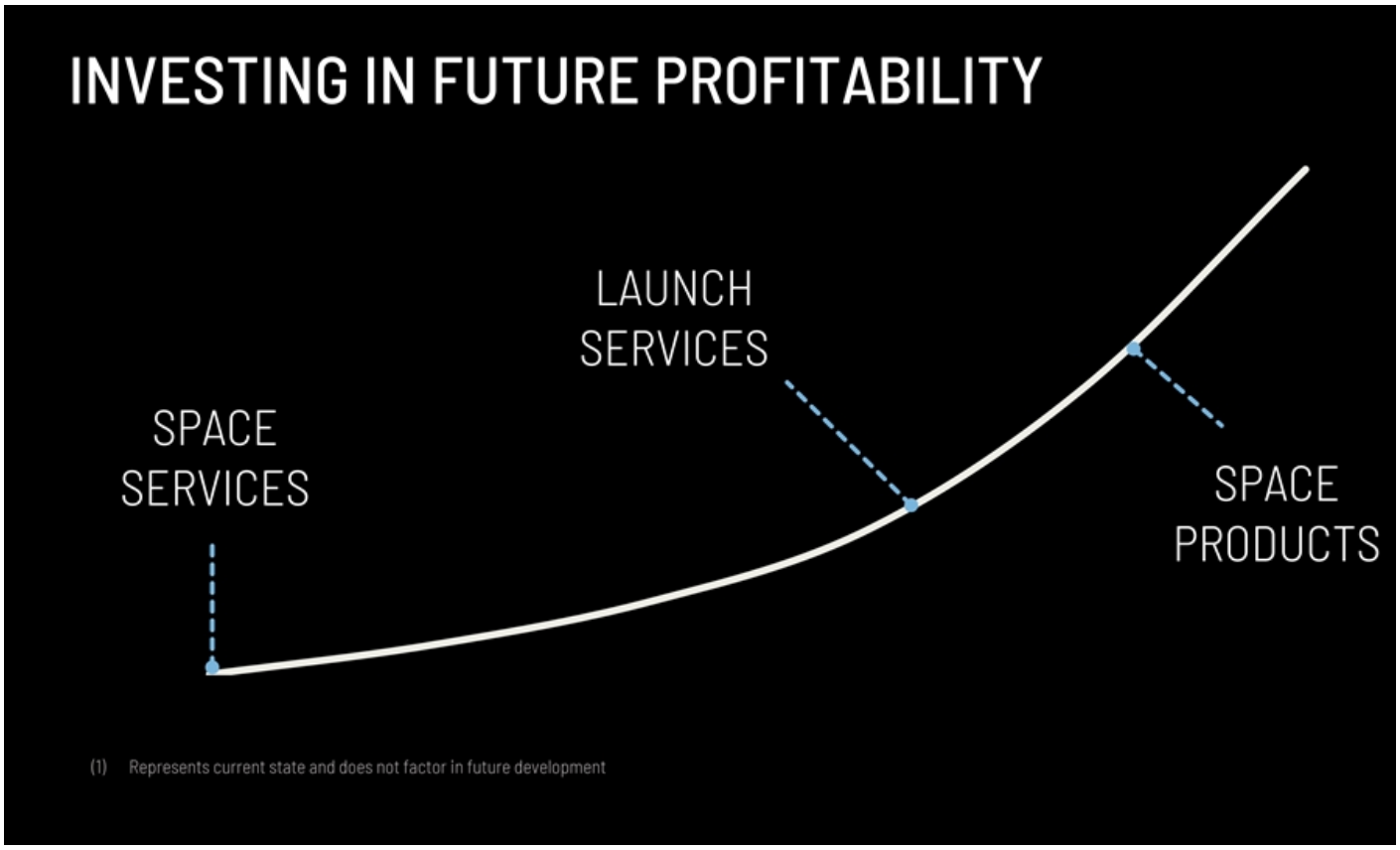
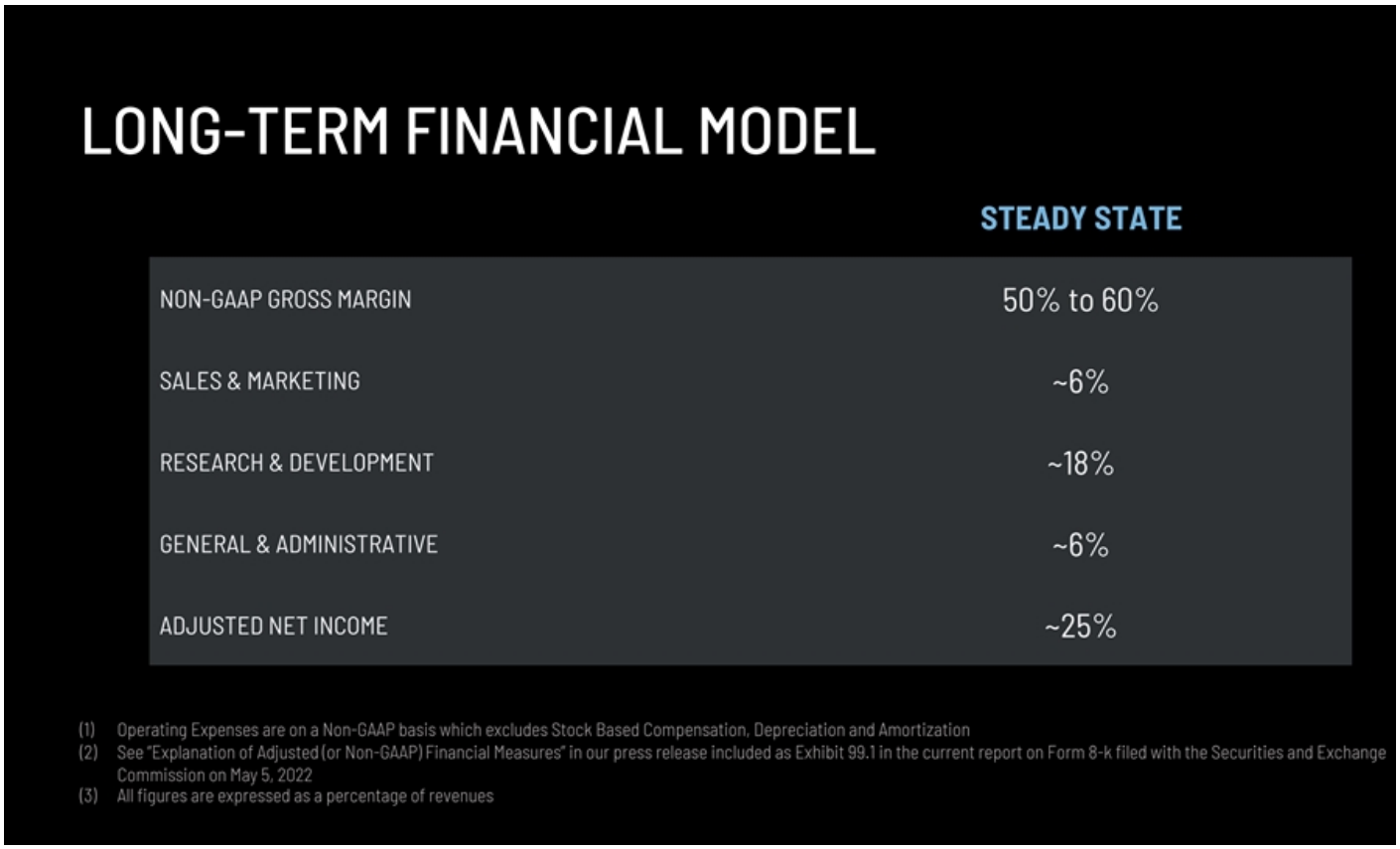
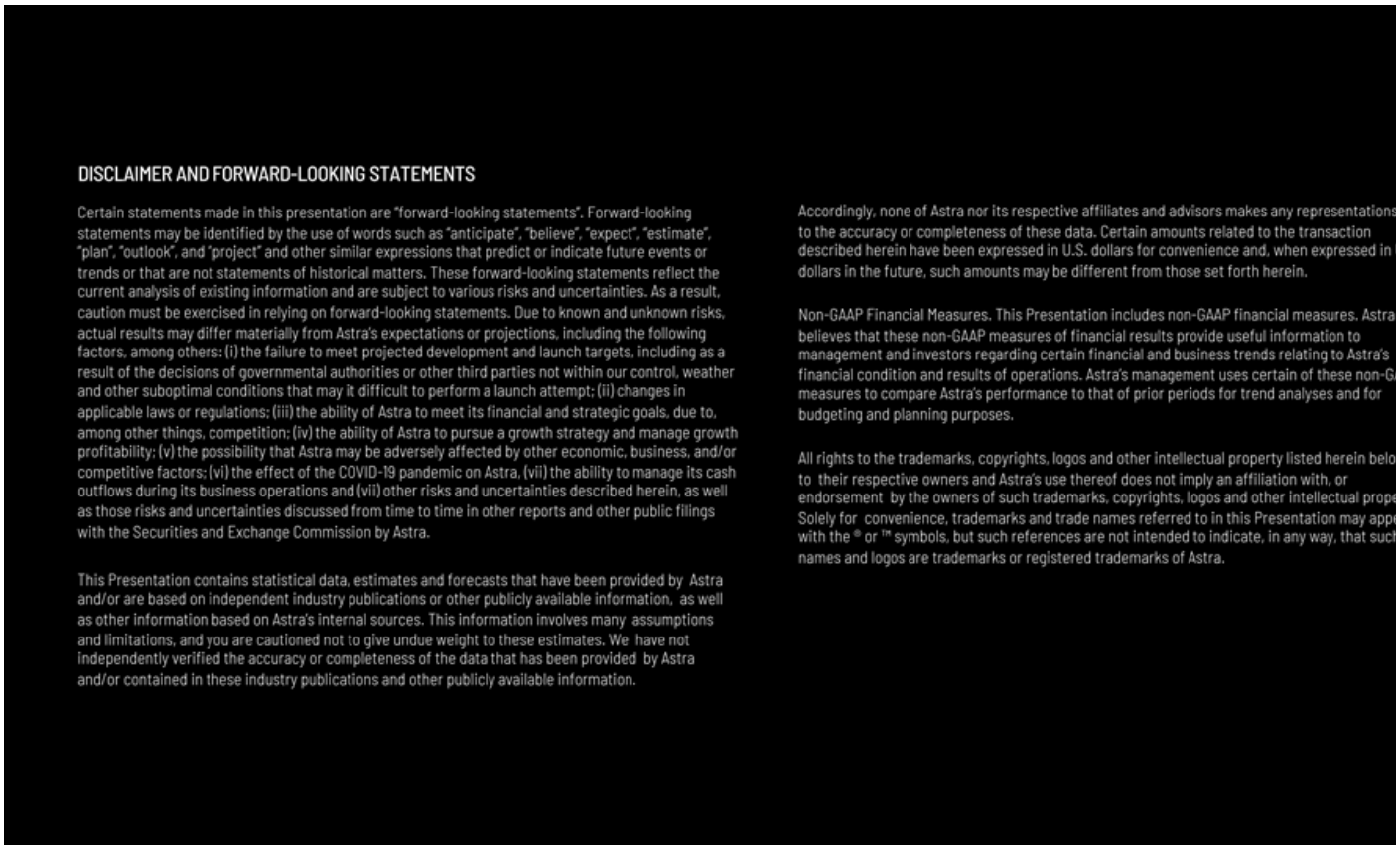



LONG-TERM FINANCIAL MODEL
STEADY STATE
NON-GAAP GROSS MARGIN
50% to 60%
SALES & MARKETING
~6%
RESEARCH & DEVELOPMENT
~18%
GENERAL & ADMINISTRATIVE
~6%
ADJUSTED NET INCOME
~25%
(1) Operating Expenses are on a Non-GAAP basis which excludes Stock Based Compensation, Depreciation and Amortization
(2) See "Explanation of Adjusted (or Non-GAAP) Financial Measures" in our press release included as Exhibit 99.1 in the current report on Form 8-k filed with the Securities and Exchange Commission on May 5, 2022
(3) All figures are expressed as a percentage of revenues



DISCLAIMER AND FORWARD-LOOKING STATEMENTS

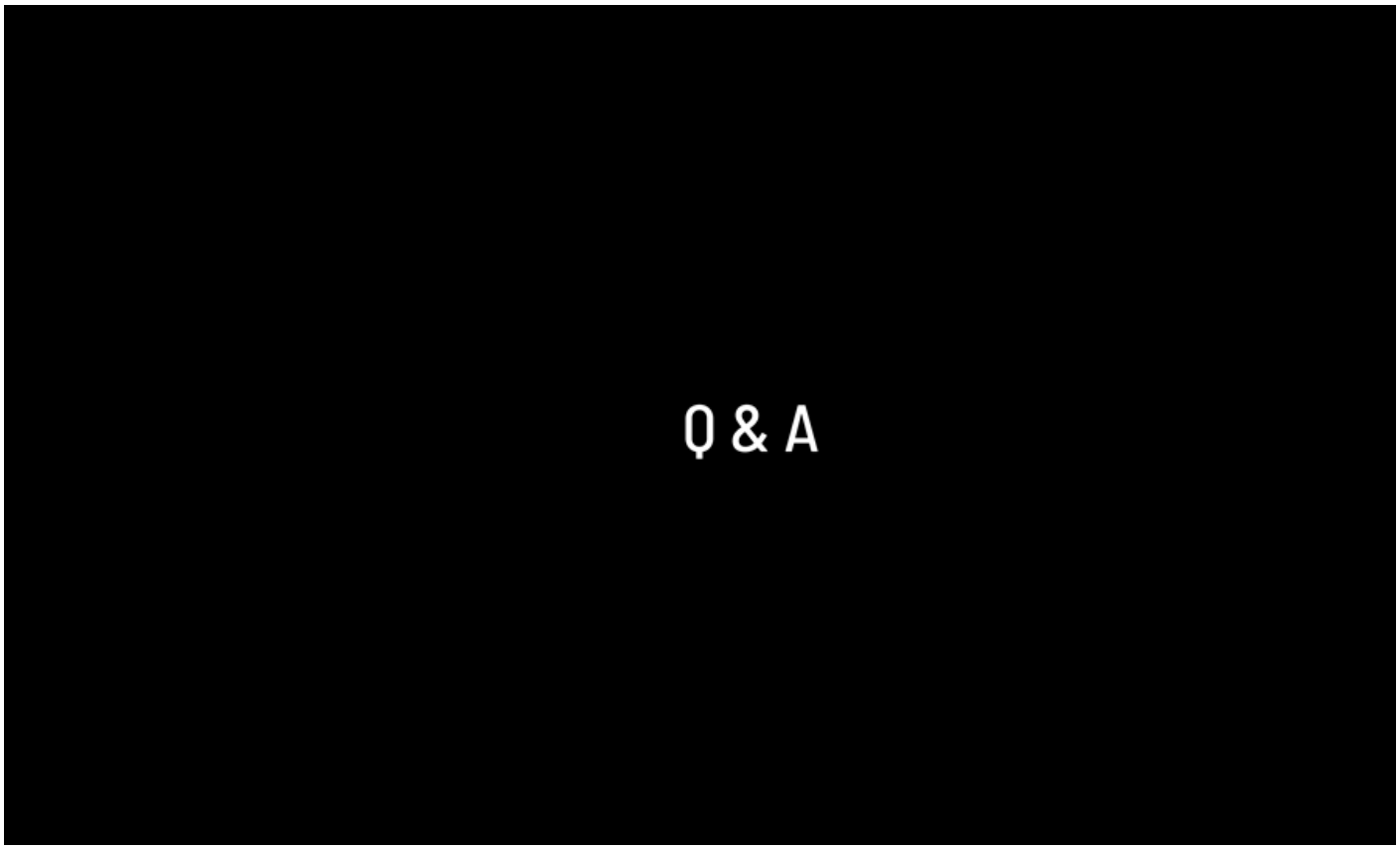
Certain statements made in this presentation are "forward-looking statements". Forward-looking statements may be identified by the use of words such as "anticipate", "believe", "expect", "estimate", "plan", "outlook", and "project" and other similar expressions that predict or indicate future events or trends or that are not statements of historical matters. These forward-looking statements reflect the current analysis of existing information and are subject to various risks and uncertainties. As a result, caution must be exercised in relying on forward-looking statements. Due to known and unknown risks, actual results may differ materially from Astra's expectations or projections, including the following factors, among others: (i) the failure to meet projected development and launch targets, including as a result of the decisions of governmental authorities or other third parties not within our control, weather and other suboptimal conditions that may it difficult to perform a launch attempt; (ii) changes in applicable laws or regulations; (iii) the ability of Astra to meet its financial and strategic goals, due to, among other things, competition; (iv) the ability of Astra to pursue a growth strategy and manage growth profitability; (v) the possibility that Astra may be adversely affected by other economic, business, and/or competitive factors; (vi) the effect of the COVID-19 pandemic on Astra, (vii) the ability to manage its cash outflows during its business operations and (vii) other risks and uncertainties described herein, as well as those risks and uncertainties discussed from time to time in other reports and other public filings with the Securities and Exchange Commission by Astra.

This Presentation contains statistical data, estimates and forecasts that have been provided by Astra and/or are based on independent industry publications or other publicly available information, as well as other information based on Astra's internal sources. This information involves many assumptions and limitations, and you are cautioned not to give undue weight to these estimates. We have not independently verified the accuracy or completeness of the data that has been provided by Astra and/or contained in these industry publications and other publicly available information.

Accordingly, none of Astra nor its respective affiliates and advisors makes any representations to the accuracy or completeness of these data. Certain amounts related to the transaction described herein have been expressed in U.S. dollars for convenience and, when expressed in dollars in the future, such amounts may be different from those set forth herein.

Non-GAAP Financial Measures. This Presentation includes non-GAAP financial measures. Astra believes that these non-GAAP measures of financial results provide useful information to management and investors regarding certain financial and business trends relating to Astra's financial condition and results of operations. Astra's management uses certain of these non-G measures to compare Astra's performance to that of prior periods for trend analyses and for budgeting and planning purposes.

All rights to the trademarks, copyrights, logos and other intellectual property listed herein belo to their respective owners and Astra's use thereof does not imply an affiliation with, or endorsement by the owners of such trademarks, copyrights, logos and other intellectual prope Solely for convenience, trademarks and trade names referred to in this Presentation may appe with the ® or ™ symbols, but such references are not intended to indicate, in any way, that such names and logos are trademarks or registered trademarks of Astra.


Q & A

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UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549

FORM 8-K

CURRENT REPORT
Pursuant to Section 13 or 15(d)
of the Securities Exchange Act of 1934

Date of Report (Date of earliest event reported): May 12, 2022

Astra Space, Inc.
(Exact name of Registrant as Specified in Its Charter)

Delaware	001-39426	85-1270303
(State or Other Jurisdiction of Incorporation)	(Commission File Number)	(IRS Employer Identification No.)
1900 Skyhawk Street Alameda, California (Address of Principal Executive Offices)		94501 (Zip Code)

Registrant's Telephone Number, Including Area Code: (866) 278-7217

Check the appropriate box below if the Form 8-K filing is intended to simultaneously satisfy the filing obligation of the registrant under any of the following provisions:

☐ Written communications pursuant to Rule 425 under the Securities Act (17 CFR 230.425)

☐ Soliciting material pursuant to Rule 14a-12 under the Exchange Act (17 CFR 240.14a-12)

☐ Pre-commencement communications pursuant to Rule 14d-2(b) under the Exchange Act (17 CFR 240.14d-2(b))

☐ Pre-commencement communications pursuant to Rule 13e-4(c) under the Exchange Act (17 CFR 240.13e-4(c))

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
Class A common stock, par value $0.0001 per share	**ASTR**	**NASDAQ Global Select Market**

Indicate by check mark whether the registrant is an emerging growth company as defined in Rule 405 of the Securities Act of 1933 (§ 230.405 of this chapter) or Rule 12b-2 of the Securities Exchange Act of 1934 (§ 240.12b-2 of this chapter).

Emerging growth company ☐

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ☐

Item 8.01 Other Events.

On May 12, 2022, we held our inaugural Astra SpaceTech Day at our headquarters. This event was livestreamed through our website, and we are furnishing the transcript of the livestream as Exhibit 99.1. This transcript should be read in conjunction with a viewing of the video of the livestream, which is available on our Twitter account (@astra), our LinkedIn account (linkedin/company/astraspace) and our website at www.astra.com.

This exhibit shall not be deemed filed for purposes of the Securities Exchange Act of 1934, as amended (the "Exchange Act") or incorporated by reference in any filing under the Securities Act of 1933, as amended, or Exchange Act, except as shall be expressly set forth by specific reference in such a filing.

We also wanted to clarify a statement that our chairman, chief executive officer and co-founder Chris Kemp made at approximately 18 minutes and 38 seconds into the livestream. Mr. Kemp's statement, in relevant part, was "put into Earth orbit, satellites four years faster than any other company in history." Mr. Kemp meant the following: "put into Earth orbit, satellites four years faster than any other *privately funded U.S.* company in history." (Clarification added in italics).

In addition, on our earnings call on May 5, 2022, we reported that we had entered into contracts with customers for the sale of 61 units of our Astra Spacecraft Engine. On our livestream, we reported that we had entered into contracts with customers for the sale of an additional 21 units of our Astra Spacecraft Engine, making the total of 82 units of our Astra Spacecraft Engine under contract as of May 12, 2022.

Item 9.01 Financial Statements and Exhibits.

(d) Exhibits

Exhibit No.	Description
99.1	Transcript of livestream of Astra SpaceTech Day on May 12, 2022
104	Cover Page Interactive Data File (embedded with the Inline XBRL document)

SIGNATURES

Pursuant to the requirements of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned thereunto duly authorized.

Date: May 17, 2022

Astra Space, Inc.

By: /s/ Kelyn Brannon
Name: Kelyn Brannon
Title: Chief Financial Officer

Exhibit 99.1

Intro Video:	00:00:06	Hard problems, attract amazing people And the chance to get to work with a bunch of really great people on really hard problems is something very special.
	00:00:17	Four years ago, Adam London and I quietly founded Astra with a bold mission to improve life on Earth from space. Our
	00:00:25	Goal is to expand access to space so dramatically that we deliver things to orbit every day, but it always starts with one.
	00:00:43	And Astra's LV triple zero seven has successfully reached orbit, there is a new orbital rocket.
	00:00:48	This is an incredibly hard thing to do, uh, continuing to do it is incredibly hard. So we're just getting started.
	00:01:13	5, 4, 3, 2, 1, 0. First motion. First motion. Vehicle has cleared the tower. LV-triple-zero-nine is it's on its way to space. There is faring separation
	00:01:25	Great news to report the payloads have started to communicate with ground stations. Our customers are calling us and indicating that satellites are alive. They're talking, which means they've been successfully deployed. We're excited to see you back here very soon for our serial number 10 flight.
Kelyn Brannon, CFO:	00:02:02	Good morning, everyone. And welcome to Astra's inaugural Spacetech Day. I'm Kelyn Brannon, and I'm the Chief Financial Officer at Astra. And it was my honor to invite you here today to join me, our leadership and the rest of our Astra team at our Bay Area rocket factory. We're very excited to share more about our mission, vision, and strategy with you. But here comes a little bit of the boring part. Before we get started I want to go over some important reminders for you. Today's event will contain forward-looking statements. These forward-looking statements, refer to future events, including Astra's future plans, product and outlook.

00:02:49 When used today, the words anticipate, could, enable, estimate, intend, expect, believe, potential, will, should, project, and similar expressions as they relate to Astra, are as such a forward-looking statement. These forward-looking statements are subject to a number of risk and uncertainties. And as a result, Astra's actual future results and performance, including our ability to achieve many plans, ideas and goals that we may discuss today may differ materially from those discussed during this event. We encourage you to review our filings with the SEC in which we describe the factors that could cause actual results to differ materially from our current expectations. Today, we'll also referenced Non-GAAP financial measures, which we believe to be useful to investors as our management team uses these Non-GAAP financial measure to plan, monitor and evaluate our financial performance. These Non-GAAP financial measures exclude certain items and should not be considered as a substitute for comparable GAAP financial measures. Astra's methods of computing these Non-GAAP financial measures may differ from similar Non-GAAP financial measures used by other companies. A description of these items, along with the reconciliation of our Non-GAAP financial measures to the most comparable GAAP financial measures can be found in our earnings release, furnished to the SEC on May 5th, 2022.

00:04:23 You're going to have an opportunity to see a ton of our technology today. This is an ITAR facility, and we have limited in-person attendance to US persons only for this reason.

00:04:37 If you were to take a photograph of an object that is ITAR controlled and published it, this is a potential federal offense. For this reason, we're implementing the following rules about cameras: You can take photos of the presentation and stage from your seat only. As we separate into groups for tours, we will ask you to put your phone in the secure bag that your tour guides will provide. And at no point during the tour, may you remove your phone from the bag. If you remove your phone from the bag without permission, or take a photograph outside the permitted seating area, you will be asked to leave the building. If you must take calls, we ask that you do so from the front lobby, your guide will point you there. A little other logistic, restrooms are back by the inventory cage. So that is back that way against the wall, both men's and women. And we would ask you, uh, to use those facilities. We will also take a few questions from the room and online at the end, please submit those to the QR code or the code on the screen. Now I'd like to invite the honorable mayor of Alameda, Marilyn Ezzy Ashcraft up to the stage. Mayor Ashcraft and the city of Alameda have been incredibly supportive to Astra as we have developed and upgraded this facility. And we are so grateful to the mayor and the city for their continued support.

Mayor Marilyn Ezzy Ashcraft: Thank you so much, Kelyn and good morning, everyone. Um, and thank you to Chris Kemp, uh, for inviting me here today and welcome to everyone who's here to watch the inaugural space tech day of Astra. It is great to be here at Astra with you, and as the mayor of Alameda, I'm delighted to learn that 63 members of Astra's workforce call Alameda home. Because Alameda is a great place to live, work and play. I'm also told that over the last year, Astra has grown its employee base by 285%. That is impressive. Astra is located here in the enterprise district at Alameda Point, which is our former Naval Air station from back in the world War II days. Actually, it was built a little before that and our vision, the city's vision for this area, is to transform old airplane hangars and industrial buildings like this that used to be used to overhaul and repair jet engines to transform those into a thriving employment center that promotes research and development, high tech, manufacturing, and sales.

00:07:38 And I am thinking that Chris Kemp and Astra could do for Alameda what Elon Musk and Tesla did for Fremont, but without any controversies. Right, Chris? Right. And so, um, right next door to where we are here is, um, what we call site A — you're right. We need more creative names. But we've been working hard on developing this area into new homes, residential also retail and parks. Those new homes could be homes to more Astra staff, just saying. The city of Alameda is also deeply committed to sustainability and resiliency. So we were proud to open our third ferry terminal. We're an island after all, we need water transport, but last July we opened the new Sea Plane Lagoon ferry terminal, literally walking distance from here and ferries from Sea Plane Lagoon provide 20 minutes service to and from San Francisco, you will not find a pleasanter, more beautiful, stress-free commute.

00:08:45 And the ferry terminal is served by AC transit line 78, which provides cross island, uh, service to meet every ferry, arrival, and departure starting and ending at the Fruitvale Bart station in Oakland. And by providing alternatives to automobile transport, we also help reduce traffic congestion and greenhouse gas emissions that contribute to, uh, global warming and lead to sea-level rise, which is an existential threat, especially to our island community. I understand that Astra's supports sustainability by subsidizing public transportation for its employees and providing onsite bicycle storage and that 27% of Astra's employees bike take public transit, including the ferry and carpool to work. Yay you! Good work. And please keep up that good work. Let's get more of you to join. Um, the, the non-automobile transport way to get to work. Astra is also engaging with the Alameda community in a variety of ways, including preparing a STEM project that will support the Alameda Boys & Girls Club, donating to the Alameda Education Fund, which supports all of our classrooms across the city, and working with the College of Alameda to establish internships and graduate to hire programs, and leading local cleanup efforts for Earth day.

	00:10:13	I'm so pleased to join you for this exciting event. And I'm looking forward to hearing more now from Chris Kemp, but I want to wish Astra every success in all your ventures. Thank you again, everyone for being here. Thank you.
Kelyn Brannon:	00:10:42	Thank you Mayor Ashcraft for joining us. It is now my deep pleasure to bring up Astra's founder, chairman and CEO Chris Kemp.
Chris Kemp:	00:10:56	Thanks Kelyn.
	00:11:02	Yeah, it's such an incredible honor to have you all come and visit us today and for the hundreds of you that we're able to, to tune into our webcast today, uh, we've got an incredible morning setup. Uh, for those of you who are here, we're going to be unveiling some, uh, of the details of our product roadmap, our strategy. For those of you here, we're going to do some tours. We're going to actually see some of the hardware that we're going to talk about in the presentation today. And we're going to be sharing as much of this as we can on the live webcast as well. So, as we get started, I want to underscore why we're all here today. I think that in the last 50 years, I have never seen a more significant opportunity to improve life on Earth then from space. And as we look over the past few months, the impact of space has been clear when this image was taken on February 15th, Vladimir Putin was, was talking about how his troops were retreating from Ukraine.
	00:12:01	This is a picture of the Pripyat River, where on the Russian-Belarus border, a pontoon bridge was built and four hours after Putin said he was retreating this bridge was imaged from a Planet Lab satellite. This is a startup that didn't exist a few years ago that is showing us that the world's most, one of the world's most powerful leaders and most powerful nations was lying to us all. And the images that we're seeing from companies like Planet and Maxar are providing an unprecedented level of honesty, truth, and transparency to world affairs that we've never seen before.

00:12:41 When the leader of this country needed to communicate with the outside world to reach us. He didn't use CNN. He didn't use the internet. He used TikTok connected through a Starlink terminal, and there's been an effort to try to connect the country, not through infrastructure that we take for granted because that's all been destroyed. But through space. Through a constellation of satellites in low Earth orbit that are providing connectivity to the front lines, to our troops, to our allies in this country, this is a private company that didn't exist again with this service just five years ago. We're about to see and hear from NASA. We're going to hear about how a, a satellite that used to be the size of a car has been shrunken down to a 10 by 10, 10 by 30-centimeter cube. And we're able to see inside hurricanes with unprecedented temporal resolution to understand their trajectories so that we can get people out of harm's way and we can evacuate people before the hurricane strikes. This kind of capability simply didn't exist a few years ago and through a collaboration between MIT and NASA, we're able to deploy an entire constellation of satellites, uh, in, in just a few months.

00:14:00 So the, the precedent here is we, as we see these opportunities to use space to improve life on Earth, you have to be able to get to space. And the problem is with hundreds of new companies, building new applications and new small satellites, they have to wait to get to space. They have to wait until a rideshare mission, a large rocket, uh, is going to the place in the space where they need to go. And until then they can't get their, their satellite into space. And so if you look at this opportunity, it is truly being gated by access to space. If you have a new application, a new sensor that you're trying to develop, and you're, you have a business that you're trying to fund a service that you're trying to provide, and you can't get it into space, you're held back, your revenue streams are held back.

00:14:43 Your fundraising is held back. Your ability to make progress is held back. And so as we see this trillion dollar opportunity unfolding in both public and private companies alike over the next several decades, we see access to space as the key enabler for unlocking the new space economy. And so just in the last year, we've seen almost a dozen companies, I believe go public raising billions of dollars of capital to build new applications across global communications, IOT, Earth observation, national security applications. These are real businesses that are generating real revenue solving real problems here on Earth from space. And this wasn't the case 10 years ago or 20 years ago. Uh, we have customers that have collectively raised billions of dollars to build satellites, to have a huge impact here on Earth. And so, when Adam and I first met, and I can't believe that this was, this picture was taken just over five years ago in a garage in San Francisco, we imagined the potential of space.

00:15:50 We imagined the idea of dramatically increasing access of space. In fact, we coined the phrase “daily space delivery” and literally on day one. And I, I think Scott Stanford is somewhere in the audience. Uh, when we first raised our first money to build this business, the idea was simple. Let’s scale, the number of launches. And that’s a theme that we’re going to be talking and talking about throughout today. And you’ll be seeing throughout your tours and throughout the, the conversations we’re having, uh, throughout the, throughout the morning. But it is our shared vision of a healthier and more connected planet that truly inspires everyone here in the building. And I think that we might all go to space for other reasons to settle other planets, uh, to spread humanity into the solar system, but for Adam and I, and for the whole team here at Astra, and for, for almost all of our customers, the mission is here on Earth and the, the opportunity to improve life on Earth, through these dimensions of a healthier planet and a more connected planet is truly something that is inspired.

00:16:59 Uh, all of the things that you’ll see today, everything that that’s here in the building. And so the approach that we took was not to design and create PowerPoints and, and, and do it all of analysis. And then, uh, you know, five or 10 years later finally maybe build a rocket. It was within 18 months of founding the company in that garage, getting a launch license and launching our first rocket, and then doing it again a few months later. And again, and again, and again, and again. This was not the popular way to approach this problem. You know, you typically do not want to iterate with a rocket, but we felt we could learn so much more quickly if we pulled the entire system together. And importantly, also to iterate all the pieces of the rocket, we needed to build a factory that could actually manufacture a lot of the components of the rocket. And so what you’ll see today is a factory that’s actually manufacturing from raw materials, aluminum tubes, aluminum bricks, aluminum sheets, most of the components of the rocket at that loading dock materials come in — at that loading dock that leaves the building. And throughout the tours today, you’ll be able to see how we make most of the components of this rocket, the tanks, the structures, the valves, the engines electronics here in this building.

00:18:20 And of all the images that are on this screen. I’m most proud of this final one.

00:18:25 That's an image that we took from space, when we first put our first satellite in Earth orbit. So this iterative process actually allowed this team, the smallest team ever assembled, to put into Earth orbit, satellites four years faster than any other company in history and maybe eight or 10 years faster than many of our peers in this industry. This learning faster mentality of building, iterating, learning, uh, is deeply baked into our culture here at Astra. And everything that we approach our space products, our space services will benefit from this vertical integration, uh, and this commitment to learning and iterating as quickly as possible.

00:19:15 So now that we've gotten into space and we've deployed satellites into Earth's orbit for our customers, the mission is to scale. The mission is to make more rockets. And so we're scaling our launch services as quickly as possible by taking the company public, by investing capital in the machines that will allow us to remove labor from key components to continue to drive the cost of the launch vehicle down. And in a few minutes, you're going to hear from my co-founder about how essential this is to winning the market in those, in the small launch vehicle, uh, space.

00:19:51 So by ramping up our operations, we're also focused on a mobile launch architecture. So not just having a spaceport that is a fixed fortification, but having a mobile launch system that can truly be deployed anywhere we are licensed to operate in the world in just a few days with just a few people. And this will allow us to fly from more places on Earth, to more places in space, more easily. In fact, we have three of these mobile launch systems that we are deploying and able to deploy anywhere within just a few days. And you'll see them here today. Um, we're really excited to, uh, we are operating now out of two spaceports, Kodiak, Alaska, and the, uh, <laugh> one in Florida, right? Been there a lot, Cape Canaveral of course, SLC <"slick"> 46.

00:20:39 We're also excited to introduce the, uh, a new location in the UK. Uh, this is a location that we're working with, uh, the regional authorities to get licensed to operate. Uh, this is a site that, uh, we'll be able to operate perhaps the first, uh, launch an orbital launch out of Europe. Uh, if you think about what scale allows you to do, if you scale up your rocket, you end up with the lowest cost per kilogram—undeniably. Uh, the rocket equation is clear. The bigger the rocket gets, the less the fraction of the overall mass of the rocket, uh, is the avionics and is the other, the, the, all the mechanisms that control things. So the larger, the payload capacity that you can have. Makes senseA A container ship, uh, set triple seven has a lot of capacity, and it's very inexpensive to operate on a per pound basis.

00:21:30 But what we'll assert today is that if you scale up the factory and you drive the cost of the rocket down through economies of scale. Economies of scale, apply to rockets, just like they apply to everything else in the world, the more of them you make, the lower the cost. And the drivers behind this are not how many times you reuse the rocket, but it's about how many times you reuse the factory to make more rockets. So what inspires us at Astra is the aluminum can. What inspires us is taking the complexity of the rocket, simplifying it so that we can remove the parts. The simpler we make it, the more automated we make, the, the system, the lower, the cost, the lower the unit cost of the rocket is. Textron makes small aircraft—the Cessna. If you're pilots, uh, Textron makes a few hundred Cessnas per year. They cost a few hundred thousand dollars each, and it might not surprise you that, that <pointing to rocket> which is LV11.

00:22:32 One of our TROPICS launches coming up weighs about as much as a Cessna. And so if Textron can make a few hundred Cessnas a year for a few hundred thousand dollars each, why should this cost millions and millions and millions of dollars? It's actually a tube, but with a pointy end, and it has far fewer moving parts. The engines don't don't have pistons. They don't have magnetos. They don't have it's the details really matter with rockets, but it doesn't have to cost more. If you control the cost of the production of all the parts, and you make a lot of them, because then you can amortize this across a larger number of units that are being produced. So from day one, Astra's mission was to focus on simplification and scale. And through simplification and scale, the economics of launch tip in our favor. And so in the end, you can win in this at both ends of the spectrum.

00:23:24 You can either have the largest rocket and you can reuse it more than anyone else, or you can have the largest factory and you can make more rockets. They'll launch more frequently and provide more value by saving your customer's time. For every large aircraft that takes off from San Francisco airport, how many small ones take off? For every container shipthat pulls up to a port, how many trucks come in and deliver the actual shipping containers? The ratio is typically one to a thousand, right? And rockets are no different. Our ability to responsively launch our customer's payloads exactly where they need to go in space on their exact schedules has real economic value. And when you drive the cost of the system down through mass production, we will make a strong argument that there are winners on both sides of this curve. And Astra intends to be a winner on the right side of that curve.

	00:24:21	So what I'd like to do now is calibrate this with a customer that I'm honored to introduce and, and talk with here, live—NASA. I used to work at NASA and the opportunity to come partner with Adam and this entire team at Astra to build rockets, to launch NASA satellites, is probably one of the most incredible things for me personally. Um, and we are so proud and so inspired as a team to be able to launch NASA's first small satellite Earth science constellation. And so with me today, I would like to introduce the TROPICS mission.
TROPICS intro video	00:25:02	that matters to focus on number one on the list is to observe the Earth's climate. The TROPICS mission is a mission that Americans really care about because it is directly observing our climate and helping save lives and protect
	00:25:17	property. TROPICS has a very specific need for their overlook configuration. We need to go to a 30-degree inclined orbit and no one else really wants to go there. The ride shares are all going to sun synchronous, orbits, or mid inclinations. So it's very well targeted to, uh, a smaller vehicle with a very targeted, uh, insertion where they can get us exactly where we want to go. And Astra is perfect for
	00:25:35	That. NASA's selected Astra because of our unique ability to get to three different orbital planes in a very short period of time at a low cost. And so being able to launch three different times for $8 million is unprecedented.
	00:25:50	We're excited about this mission because it's, NASA's first constellation built from small satellites. And Astra's platform is really ideal because it allows us to deploy these satellites rapidly and to the precise locations where they're needed in order to make the constellation operational as soon as possible.
	00:26:07	And we have the honor of being the final and most important piece at this moment in time of their mission, which is get that hardware in space exactly where it needs to go. We see that there are increasingly smaller satellites that are smarter, that are doing cool things in orbit, but they need to go to particular destinations at particular times.
	00:26:25	The real end game here is improving our ability to forecast tropical cyclones. What we're trying to do is make measurements in the microwave wavelink region, and those have the advantage of being able to penetrate the cloud tops and see the storm thermodynamics underneath the clouds. We're going to get something we've never had before in the history of weather satellites, which is revisit rates, uh, better than one hour.
	00:26:48	For the team itself, just, this will be a massive culmination of the last three years of work of developing this launch system to be able to do these things that we set out to do from the very beginning.

	00:26:58	From Astra's perspective, it's really important because we believe in space at scale, and to do that, you need to have much more frequent launches and access to space. And so this has been an opportunity for us to really understand how can we further compress the turnaround time between launches both in terms of building the rockets and in conducting the launches.
	00:27:22	What this milestone means for us is delivering a really important mission for our customer, but also demonstrating the capability that others can leverage in the future.
	00:27:31	And so the opportunity to be a part of something like TROPICS, where you get to make a difference and make a really large impact in the lives of people and help humanity as a whole does mean a lot to me. And it really excites me as well, going into this mission, knowing that we can help do something to make the world a better, safer place for people.
Chris Kemp:	00:28:01	Cool.
	00:28:05	All right. So now I am joined by Dr. Will McCarty, the program scientist for NASA, uh, from Washington. Uh, we're going to be talking a little bit about the upcoming TROPICS mission, and he's also going to share a little bit of detail, because he manages the portfolio of small satellite missions at NASA, about his vision for, uh, NASA's use of platforms like Astra. So, Dr. Will McCarty welcome.
Will McCarty:	00:28:27	Hey, hi. How are you doing? Do you hear me all right?
Chris Kemp:	00:28:30	Yeah. Perfectly excellent. Yeah. Thanks for joining.
Will McCarty	00:28:33	Yeah, go ahead.
Chris Kemp:	00:28:36	Oh, just tell us a little bit more about NASA's Earth science program and how this mission, uh, fits into, uh, your, your portfolio.

Will McCarty:	00:28:43	Yeah. So to, to understand what my position is at NASA, I'm a program scientist. I'm a program scientist in the weather and atmospheric dynamics focus area, which is one column of the Earth science division, which falls under the entire umbrella of the science mission directorate. So, um, basically, to understand what I do, you really, it helps to know my background. My background's actually, I am a meteorologist by training. I, uh, come from, um, essentially a weather modeling perspective. And so, um, you know, it's, it's the idea of what can we use NASA satellites, NASA resources for, to basically improve the weather. But, of course, the weather then affects everything because the weather affects the composition, you know, that we have not just that you have extra CO2 or extra pollution, but how that blows around that falls back to weather. Um, and so my cons, my, my portfolio is, um, you know, it's, it's both big and small.
Will McCarty:	00:29:35	I do, uh, the global precipitation measurements mission, which is a large satellite that measures precipitation plus or minus 60 degrees all over the globe. Uh, I do the Aqua mission, which is, um, actually just launched 20 years ago, last week, which, uh, really revolutionized weather forecasting by basically measuring with vertical, vertical, uh, integrity that, that never had been seen before in the infrared. But these are big school bus missions. These are large, right. And then what I'm also have been able to, to adapt to is, is the small world. Um, and so TROPICS is coming up, uh, it's really exciting. It's, you know, shoe boxes that essentially can measure, you know, the vertical profiles of the atmosphere in, in the TROPICS. Um, we have the S mission which actually measures reflected GNSS, uh, signals. So GPS and also other constellations around the world. And you, you can actually measure, uh, wind speed and soil moisture using those signals.
Will McCarty:	00:30:29	And then finally, um, which really connects has been, how I've been in with industry is I was, I've basically been with since the inception, the commercial small set data acquisition programs. So that's, um, the idea there is, is, uh, NASA comes in and basically buys commercial data and, and tries to use it for our scientific objective. So Planet, you mentioned planet earlier, planet's one of our customers, we, we basically buy access to Planet's portfolio. We buy it with a latency because that's how we kind of keep it affordable for science. But, uh, we, you know, there's a lot of this data that's coming out there, Planet, Spire being like two of the big ones that we've kind of been around since the beginning, um, that we want to make sure that their data, if it is useful to us, and we go through an evaluation process with all the new vendors to make sure it is, but if it's useful to us, we want to get it in the hand of our scientists so that our scientists can basically better understand their scientific objectives, whether that be in my focus area or anywhere within the Earth system.

Will McCarty:	00:31:22	Um, so that kind of helps, you know, explain my, my portfolio. I, I'm relatively new to the job four months. So things like TROPICS, I was excited four months ago about TROPICS from a user perspective. Now I'm, I'm at the headquarters level, but, um, you know, this is, this is a big step forward for us, I think. And, and it adds a lot of information.
Chris Kemp:	00:31:41	Now, can you talk a little bit more about how this satellite compares to some of these school bus size or some of these large, uh, you know, automobile size satellites in terms of its capabilities, uh, given how it's being deployed?
Will McCarty:	00:31:54	Yeah. It's, I mean, the engineering of it I'll admit is over my head, I'm just a literally scientist, but you know, the fact that we're building these little three U cube sets, you know, shoe boxes that can literally do what satellites that have been, you know, have been doing for 40 years now. But, you know, they used to be, like you said, the size of, you know, a refrigerator, if not larger. Um, and they would get four channels. This one's going to have like 15 channels, which is what our, like, best have. Now it's measuring at different frequencies. That's how you shrink things down. Um, but it's going to give us the ability to basically measure the vertical profiles of temperature in and around hurricanes, uh, the vertical profiles of the water vapor in and around the hurricane and also image the hurricane itself. So we can kind of do that with existing satellites, but with existing satellites, we get a picture when the satellite goes around and in LEO, they get basically two pictures a day with TROPICS.
Will McCarty:	00:32:46	We're going to get this ability of not just seeing them but seeing them with multiple revisits and quick rapid revisits. So, you know, with adding one, even just adding a second orbit to, to the, to one orbit allows us to then see the time evolution and, and the time evolution is, is really the important part that we're missing here. The time evolution, um, when you feed that to the models that doesn't just the temperature and moisture that you see directly, but it allows the models to understand how the wind fields are adjusting to, because you have to adjust the windfield based on how the storm is evolving over these short time periods. And that then results in, um, you know, basically more accurate predictions. So, um, you know, it's, it's so, and then you can just think of how that scales, right? You could literally launch dozens and dozens of orbits, but, but the reality of it is you can't do it with one orbit because the Earth's always spinning beneath you. So you have to kind of put up complimentary orbits to get that revisit, but that revisit is really what we're missing in the modern observing system.
Chris Kemp:	00:33:40	So the mission's been designed so that the more satellites, the more launches the, the higher, uh, the revisit rate is. Right? So can you talk to me more about, uh, what you consider mission success and how the mission was designed and, and why, how you chose Astra as a provider given how early we are in our program.

Will McCarty:	00:33:58	Right. Yeah. Well, you know, the idea here is this is, this is a fairly new paradigm for, for NASA that, that we would, you know, basically be able to build six, relatively inexpensive satellites through the source venture programs, the source venture, program's a neat program in that. It's basically very experimental, right? The, the, the proposals are written by the PI with both the engineering side of how to build the instrument, but also the scientific objectives that they're trying to reach. And, and so the idea here was, okay, you could build these things and now we could build them and we could put 'em up into space. But if you think of traditional launch services, um, <laugh>, we'd be spending many multiples of, of the instruments themselves to get two orbits out of this. Um, you know, this constellation or plus two, you know? Um, so Astra provides this low cost opportunity and this low cost opportunity, um, really opens up an entire slew of, of different scientific objectives, not just for TROPICS, which is kind of the first example, but it really opens up the whole world as we, we develop these small satellites, but a lot of those scientific objectives can't just ride along with the space station, which is where let's face it, many cube sets up until now we've gone, because we send things routinely to the space station.
Will McCarty:	00:35:10	Um, you get to pick your orbit now. There's no reason to send a communication satellite or, you know, something that commercial entities would likely put up into space into some of the orbits we want to use for Earth science. Um, so you're really able to go places that, um, there's no other reason to go. And that's, that's, what's really exciting to us is, is instead of having to, we, this basically allows the small satellites to be the primary pay lift. And that's, that's kind of unachievable right now in, in the world we're at.
Chris Kemp:	00:35:39	Yeah. So, uh, the mission was designed so that you would have some number of these satellites, uh, successfully deployed in order to have minimum, uh, success criteria for, for the, uh, the overall program. Can you talk more about that?

Will McCarty:	00:35:53	Yeah, so it's, um, you know, basically our, our minimum threshold is two orbits. You, we need two orbits to be able to see that time evolution, right? It's, it's, you know, it's the first two pages of the flip book. Um, we have three and hopefully we get three. That'd be awesome because then you even get that second page in the flip book, but really two is a huge step for us. The only way we get that temporal revisit right now is basically GEOs, stationary orbit and GEOs stationary orbit you're way up higher. So you have lower signal to noise, um, and you only see a disc of the Earth if you don't get to see the whole, the, you know, the whole circumference of the Earth. So, so the idea here is, is that, you know, two times four, um, or two times two, so four satellites that really gives us our baseline. Um, you know, but I look at these things, not just for what we're doing with TROPICS, but you know, where we go in the future. And, and the reality of it is, is, is that this is, this is the first step towards a new paradigm and, and a paradigm that's already existing. I mean, Planet Labs is flying up there with how many satellites and Spire has an entire constellation. Um, the, this is the ability for NASA to build our scientific objective primary payloads to then kind of work in that same space.
Chris Kemp:	00:36:58	It's exciting when you, the cost of the satellite continues to come down, the cost of the launch comes down, what matters is the constellation and the, and service it provides not any one launch or any one satellite. So, I know the team will do everything we can to make sure all three launches and all your satellites are deployed, but it is, it's good to know that, uh, you know, the, the price point of three launches allowed you to enable a mission where even if only two were successful, uh, like the last two of our three launches were successful. So we'd like to, we'd like to do better. Uh, but it is nice to know that even NASA is designing constellations, uh, so that the overall constellation performance is the end goal, not thinking about every single satellite and every single rocket launch.
Will McCarty:	00:37:39	Yeah, that's a really important point is our objectives are really with this new capability at hand, our scientific objectives are really built on the constellation, not the individual instrument. And so that's, and that's something that's very different than what we've done traditionally with these school buses where one instrument exists on one satellite.
Chris Kemp:	00:37:55	So you've already launched one of these satellites on a SpaceX, uh, flight. Can you tell us a bit more about, uh, what the satellite is already able to do, uh, for the program?

Will McCarty:	00:38:05	Yeah, it's, it's actually been, so just as you know, these are experimental untried technologies, right? So, so the, that, that what they did was basically there was a seventh TROPIC satellite and was their engineering bench model. And, um, after completing everything, it was realized, wow, the bench model, um, could basically be thrown up as a secondary payload and, and go up into space and give us basically some early look data to, to understand how, how it's going to function. Um, so, you know, every satellite that goes up in space has its nuances in Earth science. We, we think very much at the lowest level calibration level, everything has to be completely understood. That's how you get climate. You need, you need climate quality data to, to get to that point. Um, so, so the Pathfinder is what we're calling it, that's the first satellite. Um, the Pathfinder is in a sun synchronous orbit, and what that'll allow us, what that's basically has allowed us to do is refine and test our calibration methodologies in, on real data versus, you know, what we think we, we we're going to have coming out of the lab.
Will McCarty:	00:39:06	Um, but the other thing that's really cool about that is that we've actually hopefully extended through the beginning of the mission where then we'll actually overlap the ones going this way with this way, and we'll get better overlap. So you get a lot more simultaneous measurements from the Pathfinder, which we understand pretty well by now, but that also allows us to cross calibrate the, the prime constellation, uh, with each other. So that, um, one of the great mysteries of these constellations is how well are we going to be able to get them to match each other, um, that you know, that we, one thing you lose by shrinking down generally is calibration stability. That's one of the, the arguments. Um, but by having the Pathfinder up there, we've already demonstrated end to end the, the observation itself. And now we're going to be able to use that really to make the constellation in better agreement with each other across the board.
Chris Kemp:	00:39:50	Well, uh, Dr. Will McCarty, I appreciate you joining us today. Uh, if you were here, you'd see, uh, we have LV10, uh, about to leave the building, LV11 here next to the stage, uh, and on the production line, LV12 and other things. So, uh, we'll, we'll shoot some video of it and send it to you. Uh, thank you for inspiring me, everyone here at Astra. This mission is really important to us and, uh, we're going to do everything we can to deliver for you and your team.
Will McCarty:	00:40:14	We appreciate it. Thank you. Fun stuff. So good.
Chris Kemp:	00:40:19	All right. I'd like, and I'd like to dig a little bit more into this idea of scaling the number of launch vehicles, the economics, and the rocket science behind it. And there is no better person to do that than my co-founder, our Chief Technology Officer, Dr. Adam London. So with that, Adam,

Adam London:	00:40:39	Thank you, Chris. Welcome to the rocket factory. Thank you all for coming. I'm excited to get up here and spend a few minutes talking about the question that we get asked a lot, which is why small rockets. Fundamentally, there are three reasons that I'll highlight. First, orbital complexity, similar to what, um, Chris and Will were just speaking about, uh, make small rockets, very useful, versatile, and valuable to our customers like NASA and others. Second, the economies of scale make small rockets cost effective. And third, small rockets are frankly, easier to make than big rockets, and so that is actually capital efficient to do that, um, as a company that's new and growing. So, let's get into it with a bit of Astradynamics.
Adam London:	00:41:32	I like to say that are many addresses in space. On your home, you have your street number, your street, and your zip code. In space, there are actually six things that define an orbit, but three are most important, as well. The altitude, sothat's how high above the Earth you're circling, the inclination, which is the plane that your orbit is in, how far is that above the equatorial plane of the Earth, and then the rotation of that plane, which is basically, where as you clock it around the Earth, does your satellite cross the equator? And that's called the Local Time of the Ascending Node for asynchronous orbit or the Right Ascension of the Ascending Node for sort of a more generic orbit. And fundamentally, constellations are built up of many planes. So, we just heard about the TROPICS mission, that's three planes, two orbits per plane.
Adam London:	00:42:25	All of them have the same altitude and inclination, but the three orbits are clocked in rotation, um, 120 degrees so that they are evenly distributed around the Earth. And the thing that you need to know from the sort of rocket science set of things is that it's really expensive from a time and energy perspective to change planes in particular, but even any of your space addresses once you're in space. And so that's one of the reasons why TROPICS is so much easier to do with three launches than trying to do it with one bigger launch and waiting for a very long time to get the things to the right locations.

Adam London:	00:43:06	Um, as you look at other bigger constellations, there's some that have been proposed with thousands of satellites in hundreds of planes. Um, and this gets very, very complicated. But fundamentally, it's important if at all possible, to launch directly into the correct orbit, go direct delivery to the right space address. And that is fundamentally what our dedicated launch service is designed to do. So, what do our customers need as they're building and deploying these constellations? Initially they need deployment to all of their orbital addresses. Then over the life of a mission, they'll need to add spares or move spares or replacement during operations, which go to specific individual addresses. And then at the end of life they will want to replenish the, the constellation. And that means all addresses have to be touched, but if satellites last different amounts of time, you don't want to go to them all in the same order. So, you want to be able to very precisely, replenish potentially one satellite at a time, maximizing the value of that very expensive asset. And perhaps most importantly, our customers want to do this quickly, because time is money, particularly in space. When you're launching a satellite that costs a lot of money, you need it to generate the revenue to bring that back. And this typically means that a month of a satellite's time is worth 10 to hundreds of thousands of dollars.
Adam London:	00:44:40	And that actually can really help benefit the idea of responsive, uh, quick launch. So, Astra is out to solve all of these problems. Whenever, you need to get something to space quickly, we would love to help. And our responsive capability and scale, we believe will enable that. When you're deploying low density, constellations like TROPICS, which is six satellites, but spread all the way around the Earth, a small system like Astra is often the best andn the fastest option to make that happen. In higher density constellations, where you can benefit from the bulk deployment of very large rockets, Astra still has the role to play. We think we can complement them by delivering those last few satellites required to finish out each of your orbital planes, or by supplementing the bulk capacity for a small subset of your total thing to accelerate deployment and make the whole constellation operational faster at a really fairly small, incremental, um, cost to the average delivery cost. In terms of the on orbit and during operations phases, we think we shine as well.

Adam London:	00:45:47	If a satellite fails or needs to be quickly replaced, we can help do that. And then as satellite's near the end of their useful lives, we think that it's quite unlikely a whole plane is going to get to end of life at the same time. And so, we aim to enable a more focused replenishment, that might otherwise be possible. Economies of scale, we talk about scale a lot, are so core to our strategy, and so I wanted to talk about the concept briefly. What this is, which is one of my favorite charts, is if you buy a rocket or an airplane or a car and you put it on a scale, how much does it weigh and how many dollars did you pay for each of those dry kilograms? When you step back and think about rockets, airplanes, cars, you think, well, those are totally different, but in fact, they're fairly similar.
Adam London:	00:46:47	They're mostly metal, although more and more are being made from carbon fiber, they're run by pretty complicated engines and they have a growing amount of avionics and software that makes it all work. But you produce them at tremendously different rates. The demand is very different and, um, and that is the thing that fundamentally drives the cost that you can buy a car for tens of dollars for kilogram, but rockets are thousands today. And so, ultimately because these physical devices, they start with the same stuff like aluminum cost, a few dollars a pound, no matter more or less what, so the commodities that make them up is sort of at the bottom or even below this chart. And as you think about each of these charts, is how much time and energy, um, capital go into converting those fairly inexpensive, although recently trending upwards commodities, um, into a unit of something useful, this amazing device that we then go use.
Adam London:	00:47:51	And, uh, and so our objective, and I think the fundamental reason why this comes down, is that you can invest more in the automation, in the manufacturing, in the efficiency of production. And so, our objective is to move our small rockets down around to the bottom level of airplanes. As Chris said earlier, if, as Cessna can be that much, can't a rocket of similar size? So, what does this mean for small launch economics and why did we choose and do we continue to choose to develop a small rocket instead of a very large one? I like numbers and I like charts. So, um, try to avoid to much of a lecture. The sort of traditional view is that small launch is much more expensive on a per satellite basis or a per kilogram basis than big launch. And that's born out when you look at today's pricing on a price dollars for kilogram basis.

Adam London:	00:48:46	But if you think about what is possible, if you reduce the cost through scale of small launch, it gets quite a bit better. And if you, account for the value or in the inverse, the cost of losing time of big launch, they start to become much more similar on a per cost basis. And then there's something that many of you in the audience and we care deeply about, which is capital efficiency and the return on capital? The amount of time and money and effort to develop a program that can build a 10 to 20 times larger rocket costs quite a bit more than that, of a small rocket. And so, when you amortize those costs over a fixed amount of time, the sort of true economic cost of these bigger programs on a per mass launch basis increases, and they start to become even more similar.
Adam London:	00:49:40	So in short, we believe that over time on a per kilogram basis, large rockets will probably continue to be more cost effective, but we think that delta is going to get smaller and be much smaller than what you experienced today. Of course, on a per launch basis, which is to think that drives many of these higher value things of quick access and responsive must. It's not even close, um, because we're able to produce a smaller thing. And so at a high level, I'd summarize our strategy as we're using scale to dramatically, to obtain dramatically better cost for launch, but at a very reasonable cost for kilogram.
Adam London:	00:50:21	And that is what we think fundamentally enables us to deliver for our customers and provide these high value consolation, deployment maintenance, um, and replenishment services. Before I hand it back to Chris, there's one other thing I wanted to cover, um, way back in my management consulting days. We like to talk about what are going to be the frequently raised objections to this idea. So, let's cover one of those. Um, as you might imagine, I get a lot of questions about reusability. Why aren't you reusing your rockets? Um, and so let me say this first reusability and reusable rockets are incredibly cool. One of the most amazing and impressive things that I've ever had the pleasure to witness was those two Falcon heavy boosters landing in unison in 2018. What an accomplishment. I suspect that I have a better appreciation than many on sort of how challenging and impressive that was.

Adam London:	00:51:17	And I remain profoundly in awe of that. But I think it's important to talk a bit about the economics and sort of how we think about this question. Conventional reasoning looks sort of like this. Um, the cost of a launch of conducting a launch is pretty much the same, whether it's reusable or not. And if you can reuse the rocket four times, that means each launch is a quarter of the cost of the rocket and 20 times a 20th. And so, it's a no brainer you should reuse rockets. But my view that things are a little more complicated, particularly we can, when you consider the economies of scale,. First, recovery and refurbishment does add additional per launch operational costs. So those costs are not constant second and perhaps most fundamentally producing four or 20 times fewer rockets, each of which frankly is more complicated, likely larger, likely needs
Adam London:	00:52:12	higher margins, often is sort of somewhat lower performing for these reasons means that the per launch production cost is actually quite a bit more than this quarter or one 20th kind of factor that one would just apply.. And third, reusing rockets is hard, reusing a rocket or building design rocket, i think, we reuse 20 or 50 times is really hard. And so, you have to think about the programming capital costs that need to be amortized over all of those launches. And so, we actually believe that as you introduce reusability, the costs go up, initially and then eventually will come down and our modeling and our analysis suggests that that payoff is somewhere in the range of 20 to 50 reuses. It's highly dependent on the specifics, but pretty sure it's not two to four.
Adam London:	00:53:00	And so fundamentally when you think about this, like, do I want to invest more capital to potentially get a benefit after the end of things, I'm very, very happy to focus on making rockets simple. That's hard enough. And so, we remain intensely focused on scaling, dedicated launch. I will acknowledge it's certainly possible that we're wrong about this. There are lots of people who believe we are, but our model so far, and our understanding leads us to move in this direction as we scale and as we learn more, we'll keep evaluating the economics and if we win, we believe it makes sense to reuse. We'll absolutely consider investing. But for now — simple rockets made at scale. That's what we're about. That's what I'm very excited to do here. And I think that's what ultimately will enable us to really meet and help our customers and provide great value. It's important to acknowledge one thing about that though, to achieve that scale and to solve these future launch challenges for all of our constellation customers, we need a scalable launch system that is capable of launching almost every single satellite produced, even if it's only one or two at a time. And that means that our launch system needs to get a little bit bigger. And so I'd like to turn it over to Chris to talk about the next step we're taking on that front. Thank you all.
Chris Kemp:	00:54:29	Thanks, Adam.

	00:54:34	Awesome. So I'm about to share with you some really exciting work. Uh, the team has been iterating since day one, launch system, 1.0 rocket 1.0, rocket 2.0, rocket 3.0, 3.1, 3.2, that's version 3.3 of a system that over a five-year period of time has gotten better and better and better. And so as we talk about Astra's strategy, we talk about our launch services because you can't improve life on Earth from space if you can't get to space. We talk about the space services themselves and our progress, uh, towards building that, that platform in space. And we talk about the core technologies and the products that we need to power that platform. And so what I'm going to dive into, uh, is each of those three areas in a bit more depth. But first we're going to start with launch system 2.0. We called this one, 1.0, because it's the first one that worked.
Chris Kemp:	00:55:26	It's the first one that delivered our customers satellites into Earth orbit. But this is a system that's now been operated and developed over the last couple of years, about 18 to 24 months. And so over this year, uh, the team has been working to build the next version of the rocket 4.0, a new version of the launcher, a new version of the software that powers the entire system. And a new version of the factory to make it all. And so what we're going to dive into today, and we're going to hear from Benjamin, uh, a really deep, deep, deep dive into everything happening here in the building. And what I'm going to talk about is the design goals for launch system 2.0. We focus primarily on three areas, cadence, capacity, and cost. And so if you think about this, this is the north star for every product team working on every single component of this system. And if you think about the overall launch system — we're talking about rocket engines, we're talking about stages, we're talking about the overall launcher, we're talking about all the ground support equipment. All the stuff has to work together. So having clarity and focus and purpose is critical to bringing it all together, time and time again.
Chris Kemp:	00:56:38	But before we get into cadence, I just want to underscore how infrequent launches actually are. In Q1, it might surprise you that Astra followed SpaceX, Russia, and China as tied for the second most frequent orbital launch on Earth. We tied with ULA that also had two launches last quarter. And in a way we're not really proud of this, this, this just shows you how few launches occur on Earth <laugh> every quarter. And by doing three more launches for NASA, if Russia's not launching anymore, how quickly we move up that list and how infrequent launches truly are available to all these customers that are building all these small satellites, these innovative applications that need to be as Adam explained, launched to a particular address in space as fast as possible. And so this new launch system is designed for weekly launch. And what we mean by that is the factory was designed and scaled for weekly production.

Chris Kemp:	00:57:39	We mean that the software and the systems are designed to be operated by teams so that we can support a weekly cadence of launches and so it informs a lot of the details in the design of the system. This unlocks more launch availability, more scheduling flexibility, and a shorter time from book to orbit for our customers. And these are the things that we hear from customers are the most critical things to them. So how do we do this? Well, first of all, uh, software, we, we automate as much as we can in the factory so that we can make more rockets more quickly with less people. But we also are driving the mission control and the onsite launch operations experience down from around 21 people to eight people. And so again, a design point means that the mission control, which you can kind of see behind the rocket here, that's a pod and the old one's right there.
Chris Kemp:	00:58:34	So there's iteration actually, even in the concept of mission control the number of seats, the number of screens, the CONOPS is being evolved to use a fewer number of people which translates into lower cost. And in this new model, the idea is a pilot and a co-pilot. If hundreds of passengers can get on a jet and fly across the ocean with a pilot and a co-pilot, why can't a couple of people fly a rocket that doesn't have any people on it with a satellite that's, you know, largely most of them have to work for the customers to be happy? There's no reason. So as we think about innovating, we think about driving efficiencies in every area of the operation, including the recycle time at the pad. So the new launcher is designed to have a one day recycle time, which means we could ship a rocket, launch it, and then the following day do another launch from the same launcher. This means that we're going to have lower cost in operations, lower cost in, uh, any, anything that has to happen that's expendable at the pad so that we can continue to launch, uh, from a particular spaceport more and more frequently. Truly potentially, if we accomplish this objective

Chris Kemp:	00:59:45	operating a daily space delivery service from a single spaceport. The problem is, that'll never happen because of weather, because of regulatory issues, constraints at the ranges, licenses — and so that's why we need more spaceports. And so you've seen the announcement last week. Uh, we're working with SaxaVord in Scotland, and we have an entire team here looking across the entire world, looking at regions and areas where we can operate spaceports, because if you can truly take a mobile launch system and deploy it in anywhere that is happy to have us do a launch, uh, then we truly allow the, the company to unlock the potential of launching from anywhere on Earth to anywhere in space. But the key is the system has to be mobile. You have to reduce the number of skilled, uh, you know, onsite personnel that have to fly in so that the fewer, the people that are out there, the safer it is for the team. Um, and basically, we're be we're, we're, we're driving efficiencies and economies of scale, not just in production, but in operations as well. The second, the second key design point is capacity. Um, while many of our customers have very small satellites, an increasing number of large mega constellations have larger satellites that they're beginning to launch and deploy. So as we look out over the next 10 years or so, the average weight of a satellite, the mass of a satellite is about 180 kilograms. Some are larger, some are smaller. But as Adam said, our objective is to address the majority of the market for mega constellation customers. And so with launch system 2.0,
Chris Kemp:	01:01:25	our design point is 300 kilograms of payload to LEO. And you might ask how, how we do that. Well, first of all, it's a slightly larger rocket with more powerful engines. So we're actually moving to a larger faring that has more volume for our customers to support the ESPA Grande standard so that we can take a lot of common satellites that are being designed for other rockets and launch them on our rocket without having to be designed for our faring. We're moving from five engines to two, this reduces the cost, it reduces the number of engines we have to manufacture, uh, and these new engines, which you'll see here on the tour today — I think I have a video too, one running — um, it's a really cool engine, has fewer parts. Um, doesn't have big batteries, uses turbo pumps, so it's a lot more efficient. And actually I do have a video! So we're going to play a video of the engine that you're about to see on the tour, running through its its qualification acceptance test. This engine produces 35,000 pounds of thrust — so two of them will produce a total of 70,000 pounds of thrust. This replaces the current engines that produce about 7,000 pounds of thrust — so five engines that collectively produce 35,000 pounds of thrust are being replaced by two engines that collectively produce twice as much thrust. So two fifths as many engines with twice the thrust.

Chris Kemp:	01:02:54	Um, we have several of these engines, our we're setting up a production line of these engines, which you'll see, uh, so that we can reduce the number of total engines we have to produce. As we continue to increase the production rate of rockets.
Chris Kemp:	01:03:07	It goes for a while, which is what you want them to do. Um, while we continue to focus on capacity, uh, we are continuing to, to drive costs down. And what this means is our base launch price will be only $3.95 million, uh, which is a lot less than many of our competitors. And as Adam showed you while the dollars per kilogram might be more, that dollars per launch remains low. And by continuing to offer what we hope to be the lowest price per launch, we'll continue to attract customers., uh, especially as capital is more expensive for our customers. As, especially as we go into times of economic uncertainty, we believe that our customers are going to choose the lowest price per launch. And so it remains our focus to, to own that right side of the curve by continuing to drive cost down. And so, as we look ahead, we're never done. Uh, the teams that work at Astra to make better engines, better stages, better rockets, better software will have a 3.0 right behind it.
Chris Kemp:	01:04:10	And with 3.0, we'll continue to focus on what our customers tell us they need. And every indication is that the capacity will need to continue to ever so slightly increase. How much? We don't know. But our customers are telling us now, and as, as constellations, like the hyper constellation fine tune and, and finalize the mass of their satellites, we can make adjustments because 1.0 is flying 2.0 will be, uh, tested and flying for a while. And then there'll be a 3.0 and a 4.0 and a 5.0. And so this idea around continuous innovation, continuous development, and continuously listening to our customers and incorporating their needs into our products is what drive drives Astra. This might be the first product-led, customer-obsessed aerospace company. We can't hire product managers from this industry, right? Because products have generational life cycles. Typically when you're, uh, an aerospace company, the product management is done by NASA. They tell you what they need and that it's a cost plus contract. There's not this continuous cycle of listening, iterating, incorporating that feedback loop into your products. And you won't see it here on your tour, but it's deeply embedded in the, in the values and the culture of every single team member at Astra. And it's really special.

Chris Kemp:	01:05:28	So now I'm going to turn to space products briefly. In order to build space services, you've gotta have the best space products you, your, your satellites have to have fantastic propulsion systems. They have to have power. They have to have radio systems and payload performance that's market leading. And the challenge is no suppliers exist to supply a mega constellation because there's really only one mega constellation right now operating and it's SpaceX. And so we have to take every single one of these space based technologies and figure out as a company, how do we scale this? How do we take what we've done with rockets and launchers and apply it to these other key critical space technologies? Take this factory that we've built, take the vertical integration capability, the ability to do the test facilities that you're going to see on your tours today and apply them to every critical core space technology.
Chris Kemp:	01:06:20	Our first space technology we acquired last summer with the acquisition of Apollo Fusion. I'm proud of this team. I'm proud of the work they've done because we've already sold 82 of these engines. And if you listen to, to my earnings call last week, we'd sold 61. And so this product is working in space. It's, it's being adopted by customers. And the more these we make, just like the rockets, the more the cost comes down, which means the more we're going to have market leading space services potential. And again, we're just getting started on identifying, uh, the strategies that we're going to use to introduce new space products that are going to power the space services. So on to space services. Uh, the team here as we continue to make progress on our launch system, um, is making very strategic investments in building the first prototypes of the Astra spacecraft for our constellation. And all I'm going to do is tease you with it here today. This is going to be something that we will apply the same values, the same culture, and the same approach to, but we're not going to build it by integrating a bunch of parts. Ultimately, what we have to do is we have to bring the best space products to bear,
Chris Kemp:	01:07:43	so that we have the best capabilities on orbit. And the great thing about that is that creates revenue potential for Astra there's potential in taking the best technology, productizing it and selling it to our competitors, just like a popular electric car company said, if we want to electrify the auto industry, we need batteries and sold batteries to many other automakers. We see an opportunity in building revenue streams for Astra around taking our ability to get to space fast, develop our own space products, space qualify them faster, and create opportunities for Astra and our customers to have the best space technologies in their constellations. And the fact that we've sold 82 of these spacecraft engines is an early indicator of the value of this, uh, opportunity.

Chris Kemp:	01:08:38	So with that, we're going to show you the exciting stuff. Uh, you've had to listen to me and Kelyn, but uh, but I'm going to introduce Benjamin Lyon after 23 years at Apple, uh, where Benjamin led a lot of the core technology development in the iPhone, uh, is, uh, own, uh, issue, uh, robotics programs. Uh, he, after many, many months of, of coming in visiting and hearing what we were doing and hearing about what we were trying to do for Earth, he left Apple to join Astra. He leads engineering, launch operations. Uh, he leads manufacturing and today I hope you get the opportunity to tour with him because he's, he's going to take you to all the places. He's going to show you a lot more detail into how we're pulling launch system 2.0 together, and some of the other core space technologies. So with that, Benjamin Lyon.
Benjamin Lyon:	01:09:21	All right. Yes, sir. Nicely done. Thank you, Chris. And thank you everyone joining us here today, as well as online. Um, it's super, super exciting to welcome you, uh, here to Astra. Um, you know, to me, uh, small cross functional and diverse, uh, teams that are largely independent, um, are like part of our secret sauce and what it's, what enables us to, uh, move so quickly and also will enable us to adapt as we learn more and more about the market as the market evolves. And so when you get these really small, um, teams, it really makes the magic happen. And rather than kind of tell you about it, I'd like to just show you. Um, if you think about the factory that you see today, this is what most of it looked like less than a year ago. And we have this amazing real estate team, um, that took this and this, and turned it into this and then this, and now this,
Benjamin Lyon:	01:10:27	And for us, once you have an incredible space, then you can start to facilitize it, um, with all of the capital equipment needed really for scale. And when we think about what equipment to bring in, we think about automation and we think about particularly what automation, uh, makes sense for what we're doing here. On one hand, we want to do scale. Um, on the other hand, we know that the market is evolving. And so we're very, very tasteful about where we bring in automation in order to drive app, uh, tak time, but also have the flexibility in order to adapt as we learn. And so in general, where we see activities that are highly repetitive, we bring automation, we bring robotics in, in order to speed those things up. And you'll be able to see some of that today. In addition, we've been deeply investing in people.

Benjamin Lyon:	01:11:21	Our team is an incredible team. It's incredibly diverse. They come from all over the industry and all walks of life. It's one of the most exciting things for me personally, about working at Astra is that I get to work with people from all various different backgrounds. This is Felix here. He's one of our, uh, lead, uh, weld, uh, engineers. We have Susan and Tim here. Um, also they do welding and they do assembly and test. Um, we also have a great intern program at Astra. And one of the great things about interns is that they don't know what can't be done, and they ask the most incredible questions. And those questions often cause us to go, oh, you know what? That's not the way we did it in aerospace. It's also not the way we did it in tech, but guess what? That's a brilliant idea.
Benjamin Lyon:	01:12:08	And because we're nimble, we're able to like turn and make changes based off of those ideas. Um, you know, here, we've got Emily and Nick, uh, working with Kyle on the assembly, uh, of our faring. The other thing that we thought deeply about at Astra is all the challenges that we already see the world is seeing in the supply chain. And we think hard about vertical integration, but we also look deeply into where can we have great partnerships with the supply base? And so Will, uh, Drewery actually joined us, um, from the automotive industry and it's built out this incredible supply chain team that is working deeply with the, uh, supply base in order to get ahead of a lot of these supply chain challenges. And it's, what's enabled us to have multiple rockets and build, um, that you see here today at the factory.
Benjamin Lyon:	01:12:59	And of course that comes together to this, um, launch system. And one thing that you may not note in this picture is actually that strongback, which you'll also see next to the stage over here is not only the thing that supports the rocket before a launch, but it's also the packaging that we ship the rocket with. And so this mobile system has parts that actually have multiple purposes to them. And for example, we can drive it down the road, uh, in Alameda in order to take it to the airport. And we can put our mobile system on an airplane and fly it to the spaceport, or we can put it on a boat and we can ship it out to a spaceport somewhere else. And it's not just the vehicle, which is the kind of the, the thing that everybody sees, but it's also the rest of the launch mount and the, uh, support system, uh, that's needed in order to make a launch really happen.

Benjamin Lyon:	01:13:48	And so this is for example, what we call the cube, which is, uh, the launch mount, which we can literally stick it on a truck. We can ship it, um, in a ISO container and, uh, send it off to the spaceport. So as we think about mobility, we think about adaptability, we think about scale. Um, we're not building one at a time in an artisanal way. We're really looking at building parts in volume, and that allows us to drive costs down. It allows us to drive quality up and reliability up. And so, uh, that leads us to have multiple rockets out on the floor today. And we think that this ability to rapidly produce, but also be flexible, is the critical, critical, secret sauce to being responsive and providing responsive access to space. Um, and of course when it all comes together, it's really magical.
Benjamin Lyon:	01:14:39	Um, but we're just getting started and we've been getting to work on the next generation. And so thinking about the next generation, you know, Chris showed this picture of a, of an aluminum can and from the outside, it really looks like an aluminum can. Um, but there's a lot of complexity actually on the inside. Um, some of which we really can't show you, um, and that complexity drives cost. And, uh, when we think about that, we think about everything that goes on the inside as a feature and some of the very best features are the features that don't exist at all. And so we've been thinking very hard about how do we simplify, how do we drive out complexity? Because the simpler the system is the more we can scale it, the lower cost it's going to be, and the more reliable it's going to be. Um, and so this, this is like a hard problem.
Benjamin Lyon:	01:15:28	Rocket science is hard. Um, but one of the things we can leverage is the fact that our system is sending payloads to space, um, as opposed to people to space. And because we're sending payloads to space, we can think hard about a system that is reliable, um, but is not the 99.999999999% reliable because we're not worrying about, um, a human-rated system. And so that's one of the aspects we can use to optimize. So as we move forward in our roadmap, Chris talked about how we are moving, um, from multiple smaller engines to just a couple larger engines. And we have a facility today, that's actually just across the street where we test, uh, first stage engines, upper stage engines and upper stages. Um, and that's great, but this is another one of those things where we realize, oh, shoot, we've gotta build, uh, a facility that can test these much bigger engines.

Benjamin Lyon:	01:16:23	And, uh, we've gotta do that quickly. And so once again, one of these very, very small, uh, cross-functional independent teams got together. And over the course of just a few months started with this, went to this poured, a bunch of concrete, mowed the lawn dropped in tanks, put up a thrust structure. And now we have a facility that is commissioned for testing, much larger engines. And to me, this again, like it's just mind blowing how small cross-functional groups of folks can move so quickly and do such incredible work in a short period of time. We're also thinking about this from the perspective of, uh, mission control. When I first got to Astra, this was mission control. And even just over the course of the rocket launches that we've been doing over the last year, we've gotten mission control down to just a few people, and you've seen this in the livestream, um, and what's going to happen next is we're going to design a system that takes advantage of automation, um, has a great user experience, um, and allows us to drive down the size of mission control to just a few people.
Benjamin Lyon:	01:17:34	And that's really important because our goal is to operate at scale. And so we need a system that is instead of being designed for people to, um, operate largely manually, where then you add in elements of automation to kind of solve individual pain points. We're flipping it upside down and we're designing a system that eventually we intend to operate largely autonomously with humans in the loop, just to check the system along the way to make sure it's doing the right things. Also in space, um, Chris talked about the acquisition, um, of Apollo Fusion, and this is an incredible photograph of one of the, uh, Astra Space Engine thrusters is operating in a test chamber in a vacuum chamber. And, uh, for me, this was on my bucket list of things that I wanted to see in my life was, uh, you know, a hall effect thruster, they actually operating, um, but what was even cooler than that was to see it operating in space.
Benjamin Lyon:	01:18:31	Um, and this has generated, uh, a kind of a perfect, perfect match that has allowed us to think about, okay, there's great, a great kind of product market match. Now we need to go and we need to mass produce Astra space engines at scale. And so that is a project that is already ongoing today. And you can see, we are producing, um, Astra space engines already at this point. And that will be something that we continue to, uh, build out over time. And not only do you build it, but you've gotta test it and produce it. And so this concept of scale is, is fundamental to what makes innovation really matter. We iterate really, really quickly. We innovate really, really quickly, but we have to be able to do that in a way that is at scale and that is impactful. And we believe that if we do those things and we do those well and with competence, um, that will create access to space and will create, uh, great business opportunities. And so what I'd like to do is I'd like you to, uh, meet, uh, Martin Attiq. Who's our chief business officer. And he's going to talk with you a little bit more about that. Martin, come on down.

Martin Attiq:	01:19:44	Thank you, Benjamin. And thank you all. And welcome to Astra. I'm Martin Attiq. I'm Astra's Chief Business Officer. Our mission is to improve life and DPH and space. The way we do that is by providing access to space. And we believe that the potential for space is tremendous. It's already large. Chris talked about the current space economy is about 337 billion. We believe that that there's a tremendous amount of unlocked potential, and the key to unlocking that potential is access. So what I want to tell you today is share with you what I hear every day from our customers and industry partners about the pain they feel in getting space access and where we believe the future of space access will be.
Martin Attiq:	01:20:38	And I'm going to start with an example, imagine that you're an entrepreneur or an executive at a large company, and you want to build connectivity for autonomous vehicles. Autonomous vehicles require level five driving. What level five driving means is that you need to be connected to a network or a high availability network that is reliable to achieve that, um, you need connectivity, uh, that you can, you know, rely on. With a terrestrial network that's extremely difficult. You can't rely on a terrestrial network to always be connected. However, with space, it's very possible to be connected with a high reliable network, but then you say, okay, I have to go build this network. So how do you do that? Well, you have to design a constellation. You have to design, build, test space, qualify satellites, and the, and the components ensure that their radiation hardened so that they can work in space.
Martin Attiq:	01:21:40	You have to acquire spectrum rights so you can connect from space to the Earth. You have to build an entire ground network. You have to build a service model for customers. You have to, uh, hire a launch company to go and launch them into space, and then you gotta maintain it all — forever. That's exhausting. And what it also means is, is a tremendous amount of capital, hundreds of millions, perhaps even billions of dollars to go build this constellation. It also means you have to spend a tremendous amount of, um, time and money to build the technology, all the R and D that's required. And thirdly, it could take many, many years. And so this combination of capital, technology development, and time are, um, resulting in hindering the ability for the space economy to really be unlocked. So now imagine that you're that same entrepreneur or that you're that executive, who's trying to build connectivity for autonomous vehicles. And I told you that instead of spending hundreds of millions or billions of dollars spending many, many years, and doing all this technology development that you can instead just plug into a platform that already exists in space. That is our vision for the future of space access.

Martin Attiq:	01:23:11	This is not new. These transformations have occurred in other industries. This happened with cloud compute. For those of you that are old enough to remember a decade ago or two decades ago, if you wanted to build a company or a product that's based on compute, you would have to go to a data center, buy a bunch of servers, get insurance, hire DevOps people. Have 24 by seven coverage, spend tens of millions or hundreds of millions of dollars to go build it out. And then you have to go maintain it all and make sure that you're up to date all the new technology and all, all the new security and that experience sucked. And it led to, uh, it inhibited the ability for startups to grow and for enterprises to grow. And this is the same transformation that we believe will happen in space and at a high level uh, this transformation is not only new to compute and, and to space, these transformations have occurred throughout history where you simply take something that is really cumbersome and has a high capital expenditure, and you turn it into a recurring revenue, um, over the long term.
Martin Attiq:	01:24:27	So this opportunity is massive. Morgan Stanley estimates that it's a trillion-dollar opportunity by 2040. And I want to walk you through how we're going to solve the pain points of our customers in each of the phases, you know, before we unlock it, you know, with space services in phase three. So with phase one, we have launch services that we discussed today that are low cost, and they can provide ready access to space. With phase two, we're developing core technologies and space qualifying them and producing them at scale so we can support the space economy with those critical components. And then phase three is where we deliver a plug and play, where we leverage the idea that we have this incredible launch system and space qualified hardware to go deliver that plug and play solution. And we believe Astra is uniquely positioned to deliver that. Why, because of this factory, that we've built, the launch system that we've demonstrated, and the space products that we're qualifying, and ultimately that's where we see the future. And with that, I wanted to turn it back over to Kelyn Brannon, to talk to us about the financials.

Kelyn Brannon:	01:26:03	Again, welcome to Astra. As Chris noted, we are operating in a very dynamic and ever-changing environment. And we are just beginning, as we discussed earlier, the space economy is estimated to be 1 trillion or more by 2040. And this includes satellite services, ground equipment, satellite manufacturing, and of course, launch. That means the space industry today is at an inflection point. And we believe Astra is well positioned to take advantage of this opportunity. The current market environment continues to make capital more precious and scarce, not only for Astra, but for our customers. With this in mind, and from Astra's chair, we have efficiently deployed capital in the following areas, expansion of our production facility, which drives scale by increasing our production capacity. The acquisition of automation equipment, which will reduce cost and time our test infrastructure, which ensures we deliver the highest quality product and service to our customers.
	01:27:13	And lastly, continuous development of our product and services, which allows us to address our customers need. When you look around and when you go on the tour, you will see these investments are focused on making Astra, the low-cost dedicated launch provider, which is important to our customers as they deployed their capital. As some of you know, I was an executive with Amazon early on. I recall when Amazon began, their sole focus was on books and unleashing the distribution of books at a very large scale by investing in many phases of the growth Amazon has become a dominant marketplace that serves the world. Having said that, the Amazon we know today is much broader than simply selling and delivering books. For example, the AWS platform has enabled tech companies to build new applications without investing upfront capital in buying servers or leasing data systems with operating networks. Like Amazon, the Astra space platform will allow our customers to focus on their application instead of securing launches, building custom satellites, and operating their own constellations. This will allow our customers to accelerate concept commercial deployment of their products and services. We are laser focused on working with our customers to understand their needs and developing solutions that support their growth.

	01:28:45	As we look at our maturity curve for our different products and services, we expect there will be continuous development in our roadmap. Having said that, as you can see from the curve, we are extremely early in the development cycle for space services. Our early investments in achievement and operational milestones have led us further along the growth curve for launch services. As we drive forward launch system 2.0. Our initial investment in space products through our acquisition of Apollo Fusion in 2021, we acquired the Astra Spacecraft Engine. This product has already achieved commercial success in 2022, the Astra Spacecraft Engine is already providing positive non-GAAP, gross margin, and we have experienced customer growth illustrated by our orders for 82 engines as of today. As we think about funding to commercialization of our products, we intend to explore financial arrangements that is customary to larger capital-intensive initiatives to support the anticipated growth of our business.
	01:29:57	As we look forward and towards our long-term model at a steady state, which we have defined as the commercialization of products and services, we expect non-GAAP, gross margin to be between 50 and 60%. On a non-GAAP basis as a percent of revenue, we expect sales and marketing expensive to represent approximately 6% research and development around 18% and general administration around 6% and adjusted net income of approximately 25%. Please refer to our prior earnings press releases for an explanation of non-GAAP, financial measures and their reconciliation to the comparable GAAP financial measures. And with that, uh, let's begin a Q&A session with all of today's presenters.
Kati Dahm:	01:31:21	Alright. We are heading to Q&A, um, I'm Kati Dahm. Uh, we'll be taking a few questions from online and we will also be taking questions from the room. So we do ask that you enter your questions in Slido. If you'd like to ask it live, a member of our team will run a mic over to you. Um, so find some of these wonderful people. Our first question comes from online and the question is, uh, from Jason Nevada, why go to rocket 4.0 versus sticking with rocket three? Uh, sending this to the stage, uh, management team, take it away.

Chris Kemp:	01:31:55	There's always a new version because we're always learning. Uh, the market's constantly evolving. We're always making more of them, right? So, uh, if you take the feedback from the production team, the feedback from the operations teams, the feedback from the customers, uh, there's a huge list of things that you want to do to make it better, to make it safer, to make it more efficient, to produce. And it's, it's almost a question of, uh, you have to, you have to almost limit what you, what you do because you want to ship the next version. So you can learn more so that you can serve customers so that you can get that next feedback loop. And so it's really a question of, of, you know, how long is the appropriate feedback loop with the product of this level of system complexity. And I think, you know, what we've experienced so far is in the five and a half years of our existence, uh, we've done three major releases of the rocket, two major versions of the launch system, um, or, or the launcher. And so I think we, we, we feel that that 18 months or so, uh, product cycle gives us that right balance between capturing enough enhancements to the various, uh, products, uh, and, and getting that customer feedback loop incorporated back into the products. Uh, we're not going to make rocket three and four at the same time. It's, it's a, it's kind of like, you know, iPhone twelve, thirteen, fourteen. <laugh>
Kati Dahm:	01:33:08	Great. Awesome. Next question is from online, Anu B. has asked what are some specific examples in Astra's vision for a more diverse space economy? What new products or markets do you envision being created?
Martin Attiq:	01:33:24	That's a great question. Um, like I mentioned earlier, the space economy is already large. There's a ton of application, whether that's connecting, um, every human on Earth with high-speed internet, whether that's monitoring the Earth's climate. Um, and we believe that there's a lot of potential that is, that is, that is, that has not been unlocked yet. And, and that is because in the same way that for other industries, once you provide access, once you say, okay, we've driven down the cost of these things, and we've driven down the complexity, new applications get created. And what we're really excited about is we don't want to create every new application, we want to provide access to space so that all the great entrepreneurs and product people around the world can create new products and space. And that's what fundamentally we're focused on.
Kati Dahm:	01:34:14	Wonderful. I'd like to remind everyone, we will be taking questions from the room. So please raise your hand and we'll come to you with a mic. If you would like to ask a question, um, we'll have one more from online, but don't be shy. Um, how does Astra plan on competing with SpaceX and other existing satellite constellations? And why does this set Astra apart from the competition? This was from Flavio.

Chris Kemp:	01:34:38	I think, I think does FedEx compete with Maersk? You know, to some degree. I think if you look at our mission of focusing on improving life on Earth, and you look at SpaceX's mission of creating a multi-planetary species, and settling the solar system, uh, spreading the light of consciousness, the different missions and their different purposes, and they're going to drive at the end of the day, different engineering optimizations, and the products that we build and our products will serve a lot of customers that theirs will not, and their products will serve a lot of customers that ours will not. And so I truly believe that in that curve that we shared, uh, there will be winners at both ends of that curve. And we could not be more, uh, focused on a different set of objectives. You know, we're, we're focused on the number of rockets you can make in the factory, not the number of times that one rocket can fly as an example.
Chris Kemp:	01:35:30	And when you have a system to this complexity, it truly drives a lot of, uh, engineering decisions that are, that are deeply, uh, that deeply affect your products and frankly, segment the market. Uh, so maybe I'll hand the market aspect of that. And then maybe the rocket aspect of that just down here for a second, because I think this is a, a truly important point. You know, I think that the market does have room and in fact, critically requires, uh, companies like SpaceX to be successful on that side of the market and actually has critically requires Astra to be successful, to kind of seed all these new ideas and all these new applications and all these new startups that need that low cost frequent access to space that will, that will create this, uh, this, this revolution and this innovation, uh, and this catalyst for, uh, new applications to be built that will ultimately then need the larger rockets as well.
Martin Attiq:	01:36:20	Yeah. What I hear from customers every day is, you know, I want to get my satellite to the right place and space as efficiently, as affordably as possible. And today, um, you know, you can choose a large rocket, but it may not go to where you want to be. I think Adam said it perfectly when he talked about space has an address. You know, there's an inclination, there's an altitude, there's an LTAN. And going to an address that you don't want to go to is not very useful for, you know, providing services. And so at the end of the day, when customers think about their business models, they think about how can I drive my revenue and how can I deliver for my customers and for them, they want to build global constellations or broad constellations, um, and us precisely delivering to those specific orbits allows them to drive revenue.

Martin Attiq:	01:37:16	And so when they look at the value of if I can get a satellite to a specific address, and that will drive hundreds of thousand dollars of revenue per month, the launch cost or launch cost, you know, difference is kind of immaterial to that equation. And so what we're trying to do is we're trying to be the best in the world at driving down, um, launch cost. So we can deliver satellites precisely where they should be. And we think there is a world where someone like SpaceX can exist by large, by launching really, really big rockets, um, and going to a generic place in space. And we think there's a lot of room for companies to, um, who want to drive down the cost per launch. Um, but there isn't a lot of room we don't believe in between. And why would you want to pay more either on a per kilogram basis for a large launch or on a per launch basis for a small launch, you wouldn't, and fundamentally the products we're building is focused on driving down the per launch cost. And to Adam's point we're less focused on building really cool technology that's not useful in driving down the cost.
Benjamin Lyon:	01:38:30	I think that pretty much covers it. I'll just make one other point, which is, you know, if we are one of many, many customers on a container ship, you know, your individual importance to that container ship company is significantly less. Um, we love working with our customers and being very, very responsive to them. And so for us, this is kind of a perfect match to our DNA.
Kati Dahm:	01:38:52	Thanks Benjamin. And so now we'll take a question from in the room. We have a question from Tim Dodd, um, in the front row right there. So Elliot will come up to you with a mic.
Tim Dodd:	01:39:02	Hi everybody. Thank you, uh, for taking questions. Uh, could we just get some more details on the actual new rocket itself on rocket four? Uh, it appears to have like six times the performance, but double the thrust, so are you still using, uh, pressure fed, um, upper stages? Are you going to pump fed upper stages? Uh, is it all, uh, kero-LOX? Can you give us just kind of all the, the run down the detail on the, on the new vehicle?
Speaker 18:	01:39:24	Yes.
Chris Kemp:	01:39:25	I mean, I can share that it's, uh, pressure-fed upper stage, kero-LOX. Uh, we are moving to a turbo pumped first stage engines from an electric, uh, pump fed engines, uh, larger diameter. Uh, it'll be slightly longer. It'll still be critically, uh, a mobile launch system. So the rocket will still be transportable in shipping containers. And, uh, that's, that's kind of a key design point that we think is important because it, it really differentiates us from the large rockets, uh, when you can really pack the entire thing up, put it in a plane, a truck, a train, a container ship, move it anywhere around the world, discreetly, uh, and move it to all these spaceports that we're working really hard to open up across the world. Hopefully that's enough.

Kati Dahm:	01:40:07	We can follow up on that too more later. Um, we're, we'll take another question from online from Hasim A. Uh, why did Astra decide to acquire Apollo Fusion rather than building similar technology in house?
Chris Kemp:	01:40:21	Maybe give that one to Adam.
Adam London:	01:40:25	I think the, the short answer is capital efficiency, um, to, from scratch, go do and develop something as complicated as a hall thruster, um, is a big undertaking. Uh, the Apollo Fusion team spent years really, really working on it, iterating it, improving it, figuring out how to make it mass manufacturer, et cetera. And it was a great product that we're excited to incorporate into, um, our common platform. And so I think in general, as we look at space products, some it will make sense for us to develop internally others. It will make sense for us to partner with folks, others. It will make sense for us to license or even acquire.
Martin Attiq:	01:41:02	And I'll just add, you know, one of the big pain points in space is you have to space qualify things, and it's really complicated technology. Um, and we found a team that had worked on thousands of satellites that are currently working in space. So we found this phenomenal team, world class team, and we tested other technology and, uh, they space qualified it, you know, you know, last year. So that endeavor of getting from initial concept all the way to space qualifying a really critical component and propulsion satellite propulsion is one of the most critical components, you know, um, in space. Um, to find a team like that, that had made that much technology advancement, um, as efficiently as they did, we thought was phenomenal. And we could not have been more pleased by the market reaction. Uh, customers are in love with this product. Chris mentioned that we just added 20 more spacecraft engines, um, you know, this past week. And, uh, the, the demand continues to be really strong because this stuff is really hard and that's fundamentally what a, what Astra's about is, um, improving access to space. And if we can mass produce a product like that to help people get access, that's what we're all about.
Kati Dahm:	01:42:20	Wonderful. And we have time for a few more questions. I think gentlemen in the blue had one question here, Elliot.
Audience member 2:	01:42:30	Good morning. Uh, I, I certainly appreciate the vision of trying to, um, move things quickly, right? From a customer perspective, getting access to space is important. And I'm excited that you guys are looking at foreign launches because certainly there's going to be opportunities, uh, to, to put constellations up that will require, uh, efficiency in that launch profile and accessing that is, is going to be important. I'm wondering if the Astra team has considered, uh, acting as an integrator for things that involve either EAR or ITAR and doing a single license application that would include the payloads that may be restricted for that foreign launch as well.

Chris Kemp:	01:43:12	Yeah. When you look, when you look at these issues around ITAR and EAR these are primarily US export issues. And so by operating a system that can be totally containerized, deployed, launched, packed up and go, uh, while the US, um, maintains and US citizens maintain control of the entire system, I think is a unique opportunity, uh, for Astra just given the mobile nature of the system that we've developed. It also allows foreign countries to effectively offer sovereign space launch capabilities. So there's over 70 space agencies and it might be, uh, it, it's interesting to note that seven of them have access to space. And so we see that as over 60 sovereign national space agencies that we could potentially partner with, certainly our allies and certainly ones that have already kind of cleared some of these, uh, these export issues, uh, through, uh, TSAs with the State department.
Chris Kemp:	01:44:05	And so we're going to basically start with our closest allies, um, and partners that have already gone through this clearance process. And then, you know, as this allows us to, to continue to, uh, operate, uh, more, uh, more freely, uh, we'll hopefully have more partners that want to partner with Astra. This is about democratizing American, uh, space technology, um, and not, you know, taking some of our best satellite technology and exporting it to countries for foreign launch. Uh, and one thing that geopolitically did evolve, uh, in the Ukraine is all the Soyuz launches stopped. So about a third of the global supply of launch was taken off the map in the last couple months, uh, constellations like One Web were left without a ride to space and scrambled to partner, uh, with companies, uh, that were in some cases, competitors to fly their satellites. And so I think, uh, this is, this is a really, uh, interesting and dynamic geopolitical environment, uh, where access to launch has never been more constrained.
Kati Dahm:	01:45:04	Wonderful. We have one more question. We are running out of time and we want to get you on tours to lunch. We will address your question. So make sure you just ask your host or the person who is on or one of your tour guides, um, and we'll make sure that we are able to address those things. Uh, last question is can we have more insight on Astra's plans to build the AWS for space services? Um, and then it's followed by one other question, which I think is great. It is how is the rocket four development progress going and will it launch in 2022?
Benjamin Lyon:	01:45:39	So we're making good progress. Um, and we don't announce our launch dates, uh, well ahead of time, as we've discussed many, many times before that there are many, many things that can affect when we launch and how we launch. Um, but we've got a great team as you walk around today, you'll be able to see for yourselves much of the progress that we are making along that path. Um, one of the most critical pieces, uh, to, uh, a successful launch is the propulsion system is in the engine system. And you saw the video today. Um, so lots of good work going on there, and then I'll leave the other half of the question, uh, to Chris.

Martin Attiq:	01:46:18	Um, well, we're not ready to announce something, uh, you know, specific on space services, but the thing we are doing is we're talking to customers today about being customers of our space service, um, because they see the value of that. And the engagement we have from customers today is more strategic than it's ever been, because we're talking about immediate concerns around just getting simple access to space. So that's launch, uh, future concerns around being ahead of the game in technology. So that's building core technologies and space products, and then thinking longer term, why am I even doing any of this stuff? Why am I building all these satellites and, um, managing these constellations and putting up with all this capital and maintenance, why this plug into a service? Now, there will always be, we believe, um, customers that will want to launch their own satellites for very, you know, for a variety of reasons, but we believe that portfolio mix of launch services, space products, and space services is an interesting mix to basically, uh, democratize access to space.
Kati Dahm:	01:47:29	Wonderful. That's the time we have, we are excited to get you onto tours. Chris, do you want to close things out for us quickly?
Chris Kemp:	01:47:36	I want to thank all of you for coming from New York, from, uh, from LA, from all over the country, uh, here in person and for the hundreds of people that are joining us on our live, uh, webcast. Thanks for tuning in, uh, we're going to package all this stuff up and, and put as much content out there as we can. Uh, and transcripts are being made. We're going to be making the presentations available publicly. And, uh, this is the, the first Space-tech Day. Uh, we're excited to make this an annual event given the incredible response, and, uh, we're going to be putting a lot more thought into how we can expand and, uh, provide, uh, an even an even greater opportunity for all of our shareholders, uh, customers, partners, uh, to kind of see what we're up to. And, uh, just kind of allow you to keep checking in if you were to be here a month ago, uh, basically nothing here, uh, behind you was even there, right?

Chris Kemp:	01:48:23	If you were to come here six months ago, uh, the construction wasn't even done over here. If you were to come here a year ago, uh, the, the sample rate of velocity for Astra, uh, is high. And if there are people on your tour, uh, that have been here before, just ask them, <laugh>, you know, how fast we're going. We truly were in a garage, uh, just over five and a half years ago in San Francisco with just a few people. So, uh, what you're experiencing here is as much about culture and values and commitment to a mission and customers as it is about any hardware or anything else that you'll see. Uh, and that's why I know that there'll be a rocket 4.0 because there was a three and a two and a 1.0, that all happened in the last five years. And so the teams, uh, could not be more, we we've never had more people, uh, working more, uh, passionately for, for, for customers that are depending on us, uh, than we've had literally right this moment. And tomorrow there'll be more people. And, and as we continue to build this team out, uh, you're going to see more velocity, more commitment, uh, and, and more products. So, uh, thank you so much for coming. Uh, look forward to seeing you all on the tours. We have, I think, five or six tours, uh, that'll be starting right now.

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UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549

FORM 8-K

CURRENT REPORT
Pursuant to Section 13 or 15(d)
of the Securities Exchange Act of 1934

Date of Report (Date of earliest event reported): June 1, 2022

Astra Space, Inc.
(Exact name of Registrant as Specified in Its Charter)

Delaware	001-39426	85-1270303
(State or Other Jurisdiction of Incorporation)	(Commission File Number)	(IRS Employer Identification No.)

1900 Skyhawk Street Alameda, California	94501
(Address of Principal Executive Offices)	(Zip Code)

Registrant's Telephone Number, Including Area Code: (866) 278-7217

Check the appropriate box below if the Form 8-K filing is intended to simultaneously satisfy the filing obligation of the registrant under any of the following provisions:

☐ Written communications pursuant to Rule 425 under the Securities Act (17 CFR 230.425)

☐ Soliciting material pursuant to Rule 14a-12 under the Exchange Act (17 CFR 240.14a-12)

☐ Pre-commencement communications pursuant to Rule 14d-2(b) under the Exchange Act (17 CFR 240.14d-2(b))

☐ Pre-commencement communications pursuant to Rule 13e-4(c) under the Exchange Act (17 CFR 240.13e-4(c))

Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
Class A common stock, par value $0.0001 per share	**ASTR**	**NASDAQ Global Select Market**

Indicate by check mark whether the registrant is an emerging growth company as defined in Rule 405 of the Securities Act of 1933 (§ 230.405 of this chapter) or Rule 12b-2 of the Securities Exchange Act of 1934 (§ 240.12b-2 of this chapter).

Emerging growth company ☐

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ☐

Item 5.07 Submission of Matters to a Vote of Security Holders.

On June 1, 2022, we held our 2022 Annual Meeting of Stockholders, at which stockholders voted on proposals to (i) elect Scott Stanford to serve as Class II director for a term ending at the 2025 annual meeting of stockholders; (ii) amend the Astra Space, Inc. 2021 omnibus equity incentive plan to increase the Class A common stock authorized for issuance under the plan by 6,000,000 shares; (iii) ratify the Audit Committee's appointment of PricewaterhouseCoopers LLP ("PwC") as our independent registered public accounting firm for our fiscal year ending December 31, 2022; (iv) provide a non-binding advisory vote on the compensation of our named executive officers; and, (v) provided a non-binding advisory vote as to the frequency on which the non-binding advisory vote to approve executive compensation would be presented to the stockholders.

The Company has two classes of common stock and holders of each class of common stock as of April 21, 2022 (the "record date") were entitled to vote at the 2022 Annual Meeting of Stockholders. Each issued and outstanding share of Class A common stock as of the record date was entitled to one vote and each issued and outstanding share of Class B common stock as of the record date was entitled to 10 votes on each of the foregoing proposals. There were 153,014,529 shares of the Company's Class A common stock and 55,539,188 shares of the Company's Class B common stock represented either in person or by proxy at the meeting (which represented 92.72% of the total voting power of the Company), thereby constituting a quorum.

The final voting results for each of these proposals are as follows:

Election of Class II Director (Item 1): The stockholders elected Scott Stanford as a Class II director of the Company with the following votes:

Total of Class A Common Stock and Class B Common Stock:

Votes For	Votes Against	Withhold	Broker Non-Votes
625,927,869	0	3,862,766	78,615,774

Class A Common Stock only:

Votes For	Votes Against	Withhold	Broker Non-Votes
70,535,989	0	3,862,766	78,615,774

Class B Common Stock only:

Votes For	Votes Against	Withhold	Broker Non-Votes
555,391,880	0	0	N/A

Amendment of Astra Space, Inc, 2021 omnibus equity incentive plan to increase the Class A common stock authorized for issuance under the plan (Item 2): The stockholders approved the amendment of Astra Space, Inc. 2021 omnibus equity incentive plan to increase the Class A common stock authorized for issuance under the plan by 6,000,000 shares.

Total of Class A Common Stock and Class B Common Stock:

Votes For	Votes Against	Abstentions/ Withhold	Broker Non-Votes
610,622,907	19,032,675	135,053	78,615,774

Class A Common Stock only:

Votes For	Votes Against	Abstentions/ Withhold	Broker Non-Votes
55,231,027	19,032,675	135,053	78,615,774

Class B Common Stock only:

Votes For	Votes Against	Abstentions/ Withhold	Broker Non-Votes
555,391,880	0	0	N/A

Ratification of the Audit Committee's appointment of PwC as our independent registered public accounting firm for the year ending December 31, 2022 (Item 3): The stockholders ratified the appointment of PwC as our independent registered public accounting firm for the year ending December 31, 2022.

Total of Class A Common Stock and Class B Common Stock:

Votes For	Votes Against	Abstentions/ Withhold	Broker Non-Votes
706,464,830	1,549,755	391,824	0

Class A Common Stock only:

Votes For	Votes Against	Abstentions	Broker Non-Votes
151,072,950	1,549,755	391,824	0

Class B Common Stock only:

Votes For	Votes Against	Abstentions	Broker Non-Votes
555,391,880	0	0	N/A

Advisory vote to approve executive compensation (Item 4): The stockholders approved, on a non-binding advisory basis, the compensation paid to the Company's named executive officers, as disclosed pursuant to Item 402 of Regulation S-K, including the Compensation Discussion and Analysis, compensation tables, and narrative discussion in Schedule 14A filed with SEC on April 28, 2022.

Total of Class A Common Stock and Class B Common Stock:

Votes For	Votes Against	Abstentions/ Withhold	Broker Non-Votes
611,787,542	17,358,762	644,331	78,615,774

Class A Common Stock only:

Votes For	Votes Against	Abstentions/ Withhold	Broker Non-Votes
56,395,662	17,358,762	644,331	78,615,774

Class B Common Stock only:

Votes For	Votes Against	Abstentions/ Withhold	Broker Non-Votes
555,391,880	0	0	N/A

Advisory vote to approve the frequency of the non-binding advisory vote to approve executive compensation (Item 5): The stockholders approved, on a non-binding advisory basis, that the non-binding advisory vote to approve the compensation of our named executive officers should be brought before the stockholders every three years.

Total of Class A Common Stock and Class B Common Stock:

1 Year	2 Years	3 Years	Abstentions	Broker Non-Votes
22,427,669	306,557	606,819,235	234,174	78,615,774

Class A Common Stock only:

1 Year	2 Years	3 Years	Abstentions	Broker Non-Votes
22,427,669	306,557	51,427,355	234,174	78,615,774

Class B Common Stock only:

1 Year	2 Years	3 Years	Abstentions	Broker Non-Votes
0	0	555,391,880	0	N/A

SIGNATURES

Pursuant to the requirements of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned thereunto duly authorized.

Date: June 3, 2022

Astra Space, Inc.

By: /s/ Kelyn Brannon
Name: Kelyn Brannon
Title: Chief Financial Officer

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UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549

FORM 8-K

CURRENT REPORT
Pursuant to Section 13 or 15(d)
of the Securities Exchange Act of 1934

Date of Report (Date of earliest event reported): June 12, 2022

Astra Space, Inc.
(Exact name of Registrant as Specified in Its Charter)

Delaware	001-39426	85-1270303
(State or Other Jurisdiction of Incorporation)	(Commission File Number)	(IRS Employer Identification No.)

1900 Skyhawk Street Alameda, California	94501
(Address of Principal Executive Offices)	(Zip Code)

Registrant's Telephone Number, Including Area Code: (866) 278-7217

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Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
Class A common stock, par value $0.0001 per share	**ASTR**	**NASDAQ Global Select Market**

Indicate by check mark whether the registrant is an emerging growth company as defined in Rule 405 of the Securities Act of 1933 (§ 230.405 of this chapter) or Rule 12b-2 of the Securities Exchange Act of 1934 (§ 240.12b-2 of this chapter).

Emerging growth company ☐

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ☐

Item 8.01 Other Events.

On June 12, 2022, Astra Space, Inc. (the "Company" or "we") conducted its first launch for NASA's TROPICS-1 mission on our launch vehicle LV0010. While we had a nominal first stage flight, our upper stage shut down early and we did not deliver the payloads into low Earth orbit. We are reviewing flight data to determine the root cause of this anomaly and will provide additional information when it is available.

This launch was livestreamed through NASA Spaceflight. The video of this livestream is available on our Twitter account (@astra), our LinkedIn account (linkedin/company/astraspace) and our website at www.astra.com. Once available, we will furnish the transcript of the livestream of this launch.

Item 9.01 Financial Statements and Exhibits.

(d) Exhibits

Exhibit No.	Description
104	Cover Page Interactive Data File (embedded with the Inline XBRL document)

SIGNATURES

Pursuant to the requirements of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned thereunto duly authorized.

Date: June 13, 2022

Astra Space, Inc.

By: /s/ Kelyn Brannon
Name: Kelyn Brannon
Title: Chief Financial Officer

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UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
WASHINGTON, D.C. 20549

FORM 8-K

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Securities registered pursuant to Section 12(b) of the Act:

Title of each class	Trading Symbol(s)	Name of each exchange on which registered
Class A common stock, par value $0.0001 per share	**ASTR**	**NASDAQ Global Select Market**

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Emerging growth company ☐

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act. ☐

Item 8.01 Other Events.

On June 12, 2022, Astra Space, Inc. (the "Company" or "we") conducted its first launch for NASA's TROPICS-1 mission on our launch vehicle LV0010. This launch was livestreamed through NASA Spaceflight and we are furnishing our transcript of the video from this launch as Exhibit 99.1.

This exhibit shall not be deemed filed for purposes of the Securities Exchange Act of 1934, as amended (the "Exchange Act") or incorporated by reference in any filing under the Securities Act of 1933, as amended, or Exchange Act, except as shall be expressly set forth by specific reference in such a filing.

Item 9.01 Financial Statements and Exhibits.

(d) Exhibits

Exhibit No.	Description
99.1	Transcript of livestream video for launch of LV0010 on June 12, 2022
104	Cover Page Interactive Data File (embedded with the Inline XBRL document)

SIGNATURES

Pursuant to the requirements of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned thereunto duly authorized.

Date: June 13, 2022

Astra Space, Inc.

By: /s/ Kelyn Brannon
Name: Kelyn Brannon
Title: Chief Financial Officer

Exhibit 99.1

June 12, 2022
Astra TROPICS-1 livestream transcript

[Opening NSF video]
Thomas Burghardt (00:01:55):

Good morning, everyone, and welcome to today's live launch coverage. You are looking live at Space Launch Complex 46 at the Cape Canaveral Space Force Station, where Astra is just under 30 minutes away fr- um, conducting today's attempt for the first in three flights for NASA's TROPICS mission. We are coming to you live today from Astra's headquarters in Alameda, California. My name is Thomas Burghardt, news director for NASA Space Flight, and today I'm joined by Amanda Durk Frye, senior manager at First Stage and Engine Production here at Astra. Amanda, thank you so much for joining me this morning.
Amanda Durk Frye (00:02:23):

Great. Excited to be here.
Thomas Burghardt (00:02:24):

Astra and NASA Space Flight are once again partnering to bring you today's webcast, so thank you to Astra for helping make this all happen. Over the course of today's broadcast, as usual, we'll be taking as many of your questions as we can, so if you've got a question about today's flight, please tag us with @NASASpaceFlight in chat. We're gonna try to bring as many of those in as we can. Um, to start off, let's get of a status update on today's countdown. Amanda, where are we in today's launch attempt?
Amanda Durk Frye (00:02:48):

Well, right now, the weather is looking good for the first beginning of our window. However, it will start to deteriorate quickly due to thunderstorms that are starting to roll in. However for now we are still proceeding with today's countdown. As Thomas mentioned, today is the first day of our launch window for an LV0010. Uh, we are back down in Cape Canaveral, where the vehicle is stationed at Space Launch Complex 46. We have two days in our launch window, with tomorrow as our backup should we be unable to launch this morning.
Amanda Durk Frye (00:03:16):

Uh, there are many factors that do influence when a launch can or can not happen, many of which are entirely out of our control. These can include weather or third-party activities, or even aircraft or boats that are getting too close to our launch site. And our team will not launch if these conditions are not optimal. So we are excited to potentially launch this morning, and should we be delayed for any reason, we will of course provide updates on Twitter at @Astra.
Amanda Durk Frye (00:03:39):

We would like to also extend a huge shout-out and thank you to our partners who helped make the launch of LV0010 happen. These include our partners at Space Launch Delta 45, NASA, MIT Lincoln Laboratory and the FAA, all of whom have been wonderful to work with, and we truly appreciate their ongoing support. And of course to all of our Astra team members and their families.
Amanda Durk Frye (00:03:59):

Thank you to our entire team for their dedication to the mission, and for helping us get back to the pad once again.
Thomas Burghardt (00:04:06):

As we mentioned earlier, today is the first flight of three in support of NASA's TROPICS mission, and we've got a video to highlight the partnership between Astra and NASA on today's flight.

TROPICS video

Martin Attiq (00:04:17):

A Pew research poll showed that of nine different categories that NASA should focus on, number one on the list is to observe the Earth's climate. The TROPICS mission is a mission that Americans really care about, because it is directly observing our climate.
Dr. William J. Blackwell (00:04:31):

TROPICS has a very specific need for their orbital configuration. We need to go to a 30 degree incline to orbit, and no one else really wants to go there. The [inaudible 00:04:39] are all going to the sun-synchronous orbits or mid-inclinations, so it's very well targeted to, uh, a smaller vehicle with a very targeted, uh, insertion where they can get us exactly where we wanna go. And Astra is perfect for that.
Martin Attiq (00:04:51):

And so being able to launch three different times for $8 million is unprecedented. Because of our unique ability to get to three different orbital planes in a very short period of time at a low cost.
Chris Kemp (00:05:03):

Why I'm excited about TROPICS is, coming out of NASA, having the opportunity to fly satellites, uh, for the organization I used to work for is, is personally gratifying for me. It's also a really important mission, because we can detect tropical storms. We can help people evacuate and can save lives, and it's a mission that's really well-designed for Astra's capability, being able to put multiple rockets up into multiple planes rapidly.
Hemant Chaurasia (00:05:28):

And we have the honor of being the final and most important piece, at this moment in time, of their mission, which is get that hardware in space, exactly where it needs to go. We see that there are increasingly smaller satellites that are smarter, that are doing cool things in orbit, but they need to go to particular destinations at particular times.
Dr. William J. Blackwell (00:05:47):

The real end-game here is improving our ability to forecast tropical cyclones. What we're trying to do is make measurements in the microwave wavelength region, and those have the advantage of being able to penetrate the cloud tops and see the storm thermodynamics under the clouds. We're gonna get something we've never had before in the history of weather satellites, which is revisit rates of better than one hour.
Chris Hofmann (00:06:09):

For the team itself, just this will be a massive culmination of the last three years of work, of developing this launch system to be able to do these things that we set out to do from the very beginning.
Dr. Adam London (00:06:19):

From Astra's perspective it's really important because we believe in space at scale, and to do that you need to have much more frequent launches and access to space. And so this has been an opportunity for us to really understand how can we further compress the turnaround time between launches, both in terms of building the rockets and in conducting the launches.
Martin Attiq (00:06:45):

What this milestone means for us is delivering a really important mission for our customer, but also demonstrating a capability that others can leverage in the future.
Chris Hofmann (00:06:54):

And so the opportunity to be a part of something like TROPICS, where you get to make a difference, and make a really large impact in the lives of people, and help humanity as a whole, does mean a lot to me, and it really excites me as well. Going into this mission knowing that we can help do something to make the world a better, safer place for people.

Thomas Burghardt (00:07:20):

So Amanda, why don't you recap for us what the goals of today's launch are?
Amanda Durk Frye (00:07:24):

Right. So LV0010 marks Astra's second mission with NASA, and it is the first of three launches to deliver the NASA TROPICS satellites to low Earth orbit. Our objective for today is to successfully deliver our customers two identical CubeSats to an orbit of 550 kilometers at a 29.75 degree inclination relative to the Earth's equator. They are about 3U in size, which means each one is about the size of a loaf of bread. Uh, so pretty small CubeSats, and if all goes well we should be able to see one of our two payloads deploy through our on-board upper stage cameras.
Amanda Durk Frye (00:07:59):

Yet it is possible that we will not have confirmation for up to 90 minutes, or at least a couple of orbits, as the satellites pass over their ground networks. This is not unusual, since it is due entirely to where the loc- the satellites are located within their orbit at the time of deployment, relative to their corresponding ground communication links. So we will end the l- uh, live broadcast shortly after payload deployment, and ask that you follow on Twitter at @NASAEarth, or @NASA_LSP for confirmation of satellite communications. Astra will also share from our Twitter handle as soon as we have confirmed with our partners at NASA.
Thomas Burghardt (00:08:35):

Uh, before we go any further, we also want to recognize Dr. Gail Skofronick-Jackson. Um, she was the program scientist at NASA h- headquarters for the TROPICS mission, and sadly passed away in 2021. Her focus area was weather within the research and analysis program of the Earth sciences division under the science mission directory, and we have a video in honor of Dr. Skofronick-Jackson to show here.

Gail Skofronick-Jackson video

Dalia Kirschbaum (00:09:05):

There are many, many reasons why I will miss Gail. For her friendship, for her leadership, her science and her driven nature. And really, just for her thoughtfulness, as a person and as a scientist.
Ellen Gray (00:09:18):

I worked with Gail on the communications floor at the GP [inaudible 00:09:23] launch, and she was always so wonderful to work with. I feel like I really learned how to, you know, communicate what we needed ed- for telling great stories about the satellite, and I remember just how she lit up when she was talking about it.
Dr. Gail Skofronick Jackson (00:09:37):

So you can see these small-scale systems at a resolution of about 10 kilometers by about 10 kilometers. It's about six [inaudible 00:09:44]-
Walt Petersen (00:09:44):

You know, she was... She was just excellent to work with. Just on all levels, an outstanding friend, a great person to talk to when you had problems. Um, always willing to listen, and I'm certainly going to miss her dearly, a- as I'm sure everybody else will.
Dalia Kirschbaum (00:09:58):

She was a tremendous scientist in the field of snow remote sensing. She led GPM to its success, working with a multi-disciplinary and diverse team, and she worked to encourage and expand our team, and being mindful of, of diversity and inclusion within the GPM and the broader program.
George Huffman (00:10:19):

She leaves some very big shoes to fill, and she has provided a stellar example of how we should be carrying out science, and getting the work of NASA done.
Thomas Burghardt (00:10:49):

So thank you to the NASA and Astra folks for their partnership on today's webcast, and of course recognizing Dr. Skofronick Jackson there. Um, we're gonna go ahead and get into some questions here. We're about T-minus 19 minutes and counting. Everything appears on track so far for the opening of today's window. Um, of course, the focus of any launch is the payloads that are on board, so our first question here from Carson is, "Are these pa- satellites CubeSats on board today's flight?" Amanda?
Amanda Durk Frye (00:11:12):

Uh, yes. Uh, the satellites on board are, are CubeSats. Uh, they are two identical 3U CubeSats that contain a dual-spitting radiometer and a compact microwave spectrometer. Uh, the purpose of these are to penetrate through the cloud layer of developing or active storm fronts and provide near-hourly imagery of a storm's progression, including data on precipitation, temperature and humidity. Uh, so these CubeSats will help scientists and meteorologists to understand how storms form, grow and intensify throughout their life cycle, uh, helping them to better detect and understand tropical storms better.
Amanda Durk Frye (00:11:46):

NASA has an incredible mission overview about these small satellites that you can find, uh, a link to at astra.com/mission/tropics-1.
Thomas Burghardt (00:11:58):

Awesome. And of course today's flight is the first of three missions for the TROPICS program. There are two satellites on board today. Six satellites are planned in total across the three flights, all launching from here at Cape Canaveral. Um, today's first flight, uh, on schedule so far... Again, if you're just joining us, the launch window opens at 9:00am Pacific Time, or noon Eastern over at local time in Cape Canaveral, which is just under 18 minutes away from now.
Thomas Burghardt (00:12:22):

Keep the questions coming in, chat, if you've got 'em. We'll try to answer as many of those as we can. Um, one of the questions we're seeing in chat here is, uh, where is Carolina today? Of course, we've seen Amanda on the, the coverage before. We've definitely interviewed here before, but first time hosting, so congratulations, Amanda.
Amanda Durk Frye (00:12:36):

Thank you.
Thomas Burghardt (00:12:37):

Um, I do believe, uh, we do know where Carolina is today, though.
Amanda Durk Frye (00:12:40):

Yes! Yes, so, uh, she is not here for a very great reason today. Uh, so Carolina
Amanda Durk Frye (00:12:49):

So Carolina and family are at home resting and recovering. Very well deserved. So huge congratulations to her from our entire Astra family. Uh, but yeah, so she is at home right now, enjoying and, uh, cheering on TROPICS from, from at home.
Thomas Burghardt (00:13:05):

Awesome. So congratulations to Carolina and her family, of course. Um, some other questions coming in here. I've got one saying, uh, "How much does a rocket weigh?" Amanda?
Amanda Durk Frye (00:13:15):

How much does it weigh? Uh, so the vehicle weighs approximately 2400 pounds at, when it is dry. So that is just the dry weight of the vehicle. Uh, which doing a quick Google search before this.
Thomas Burghardt (00:13:27):

(laughs)
Amanda Durk Frye (00:13:27):

Let's find out that that is roughly the weight of an unfueled Toyota Yaris. Uh, (laughs) and then we, we do add about 2400 pounds' worth of propellant, uh, to the vehicle. So in total, you're really looking at around 2600 t- or- s- 26,000 pounds, I'm sorry. 24,000 pounds of propellant. Um, so doing some back of the envelope com- uh, calculations, that's about the equivalent of a Toyota Yaris carrying around four female elephants.
Thomas Burghardt (00:13:55):

(laughs)
Amanda Durk Frye (00:13:56):

Uh, another fun, uh, fun fact, uh, that our engineering team likes to share about the vehicle is that the wall thickness to diameter ratio of the rocket is actually similar to that of a soda can.
Thomas Burghardt (00:14:06):

All right.
Amanda Durk Frye (00:14:07):

(laughs)
Thomas Burghardt (00:14:07):

There we go. Uh, thank you to Judah for, uh, submitting that question to us here. Uh, let's see. So again, 15 minutes to go here. Everything on track so far. We'll keep some questions coming. Uh, Mitch Bunks asked, "Is this an instantaneous launch window?" I believe not. Right, Amanda? We have a two-hour launch window, I believe, today?
Amanda Durk Frye (00:14:28):

Yeah. Today's launch window is two hours. As we mentioned at the beginning, there is a small window at the beginning where the we- weather does look favorable. However, there are thunderstorms that are rolling in, uh, so the weather will continue to quickly deteriorate as we move into our window this morning.
Thomas Burghardt (00:14:43):

Got it. We'll keep an eye on that, of course. If there are any updates regarding the weather, we will happily provide those. But count proceeding towards the opening so far. Um, let's see. Some other questions here. Uh, we talked about earlier, Brent asking, "What direction is this launch going?" So today's target orbit is a 29 degree inclination, just about, which is, uh, pretty much due east from Cape Canaveral. Um, we actually saw a, um, a graphic earlier showing the, the launch trajectory zones going east from Cape Canaveral.
Thomas Burghardt (00:15:13):

There it is. Um, that is the path the rocket is planned to take, east of Cape Canaveral towards that orbit. Um, that's actually why this mission is launching from Cape Canaveral. It's because it's targeting, it's that sort of mid-inclination orbit, um, which is different from Kodiak, where Astra also launches, um, where that's more favorable for polar launches or sun-synchronous launches.
Thomas Burghardt (00:15:40):

Uh, so as you can just see, the countdown is just held at T-minus 15 minutes, so we're gonna go ahead and look for some more information on that. Um, we'll provide an update as soon as we have it.
Speaker 2 (00:17:12):

Just hang on. Countdown change is, uh, is complete.
Speaker 3 (00:17:15):

And [inaudible 00:17:15] pulling. Please toggle to both ground and guidance pulling to put the vehicle back in its nominal state.
Speaker 2 (00:17:21):

[inaudible 00:17:21] One, managed pulling to both ground and guidance. Set to true.
Speaker 3 (00:18:07):

Per step 69, Delphin. Can you confirm that the Delphin system looks ready for launch?
Speaker 4 (00:18:17):

Delphin confirms. Good for launch.
Speaker 3 (00:18:22):

Step 70. Orbit, can you confirm that ether is ready for launch?
Speaker 5 (00:18:28):

Ether's ready for launch.
Speaker 3 (00:18:30):

Tango and machine, OX1 ISO control. Set high pressure target to 90psi.
Speaker 6 (00:18:35):

OX1 ISO control high pressure target 90. [inaudible 00:18:40].
Speaker 3 (00:18:47):

Step 72. Tango verify vehicle looks okay for launch, aside from tank levels and pressures.
Speaker 6 (00:18:54):

[inaudible 00:18:54]. Confirmed. Vehicle looks good.
Speaker 3 (00:19:06):

And step 73, GNC, confirm wind profiles are still acceptable for launch at this time.
Speaker 7 (00:19:11):

Confirmed.
Speaker 3 (00:19:17):

'Kay. This takes us to our water test, step 74. Tango, in water one, water system, toggle prime to true to begin flowing water up to the [inaudible 00:19:25] system.
Speaker 6 (00:19:27):

Water one, water system prime to true. Can I flip them?
Thomas Burghardt (00:19:50):

So while teams are working to resolve this hold at T-minus 15 minutes, and again, we'll provide updates as soon as we have them, we do have a couple more questions coming in, so let's start with this one from Don, which asks, "What is the thrust of this rocket?" Amanda?
Amanda Durk Frye (00:20:03):

Uh, so the first stage of the rocket has a total combined thrust of 32,500 pounds, uh, to lift us up from the launch pad, and then our upper stage has 740 pounds of thrust.
Thomas Burghardt (00:20:15):

And what fuel combination is producing that thrust? What...
Amanda Durk Frye (00:20:19):

Yeah. So uh, we use the same type of fuel propellant on both the first stage and the upper stage, and so that is a combination of liquid oxygen and RPX, which is a highly refined form of kerosene.
Thomas Burghardt (00:20:31):

Gotcha. And so those fuel and engines are all on the Rocket 3 vehicle that we're looking right now. Um, John asking, "What rocket is TROPICS-1 sitting on?" I believe even specifically it's Rocket 3.3, but can you give us just an overview of the launch vehicle that is launching today?
Amanda Durk Frye (00:20:47):

Yeah. So Rocket 3 is a two-stage launch vehicle. Um, and here you can see in the expanded diagram, uh, you can see [inaudible 00:20:53] major sub-assemblies of both the first stage and the upper stage. Uh, so we could step through them one by one. Uh, so starting at the aft end, which is the far left side of the diagram, you see the first stage engine bay. And so on the engine bay there are five electric pump-fed first stage engines. Each one provides around 6500 pounds of thrust. Uh, so as I said earlier, for a total of 30 fu- 2,500 pounds, uh, to lift the rocket. And surrounding the engine bay is some thermal protection, mostly just to protect the engine controllers and on-board computers from the high heat environment during launch.
Amanda Durk Frye (00:21:26):

Moving towards the forward end, you see the large cylindrical section there, which is the first stage propellant, uh, storage. Um, so that is a fully welded structure that's fabricated here in-house in Alameda. All those sheet metal components arrive as rolled sheets of aluminum, and our first stage production technicians perform a longitudinal friction-stir weld up each seam before sequentially joining each one together via circumferential TIG welding operations, and that is what, how it forms the fuel and liquid oxygen tank. And you can actually see some really great videos and images of our team at work on these exact operations, um, by searching #FactoryFriday on LinkedIn, uh, to see some of our posts.
Amanda Durk Frye (00:22:05):

And although the tank looks like one large volume, it is actually split into two separate tanks. Uh, one is for the RPX, which is that highly f- refined form of kerosene, and that one sits closest to the engine bay. And then liquid oxygen. And you can see the delineation line between the two, um, as the liquid oxygen tank forms that thin layer of frost on the exterior, uh, due to the cryogenic fluids inside. And so you can see that on the live video feed of the, the rocket over on the right-hand side there.
Amanda Durk Frye (00:22:32):

Uh, continuing our way towards the forward end, that conical section is called the inner stage, and that's what houses many of our on-board avionics components. Uh, there's a radar on there, antennae, even some cameras, uh, that look down the length of the first stage during flight.
Amanda Durk Frye (00:22:48):

And again, this is a fabricated sheet metal assembly. Um, and it does have additional structural supports in there as that is how the upper stage is secured to the first stage during flight.
Amanda Durk Frye (00:22:58):

And that takes us to the upper stage, um, which is that assembly that looks like stacked spheres on this far right side of the image. Uh, the upper stage also uses RPX and liquid oxygen as its main propellants, um, and that one has a single engine, which is pressure-fed and can provide 740 pounds of thrust. Uh, the upper stage gets nestled into the inner stage during flight until main engine cut-off, when the first stage releases the upper stage for its final segment of flight. And if you look back at the first stage tank, you can see on the lock stone, those fingers that are sticking out, uh, those fingers actually do help to support the upper stage engine during the, uh, high vibrations during the first stage portion of the flight.
Amanda Durk Frye (00:23:36):

And then lastly we have the fairings, which are those two clamshell structures, uh, that go around the, um, upper stage and payload and protect it during flight. Um, and then those will pop open just after main engine cut-off for, uh, release of the upper stage. Um, and then if you do see on the right-hand image the upper stay-... Or sorry, the inner stage end fairings are also white, but that is not due to the similar frosty effect of the liquid oxygen tank. Those have a thermal protection on them, um, to protect the payload from the, uh, aerodynamic heating that is caused by the compression of air as the vehicle moves through the atmosphere.
Amanda Durk Frye (00:24:12):

So that is Rocker 3. Um, overall, we're able to deliver 25 to 150 kilograms to a 500 kilometer sun-synchronous orbit with this vehicle, and the majority of these parts are produced here in-house in Alameda. I would absolutely love to give shout-outs to every one of the technicians and engineers that help us build these vehicles. Yeah, we are on the clock this morning, so as I mentioned-
Thomas Burghardt (00:24:33):

(laughs)
Amanda Durk Frye (00:24:33):

... please take a look at #FactoryFriday on our social media sites where you can see, uh, some of our technicians at work, um, building al- all the various structures, um, of this vehicle. And if you've not also seen it before, please be sure to check out the factory tour that NASA Space Flight took with our vice president of operations, Bryson Gentile, last year. Uh, it's a great look at some of the incredible things our production teams are building here in Alameda.
Thomas Burghardt (00:25:00):

Absolutely. I'm looking forward to version two of that factory tour, because, uh, the factory has changed a lot since that video as well.
Amanda Durk Frye (00:25:06):

It has. (laughs)
Thomas Burghardt (00:25:06):

Um, so looking forward to maybe revisiting that as well. Um, we do have a brief update on the hold. Again, we're holding at T-minus 15 minutes. It is now confirmed, uh, the hold is due to some boats in the safety hazard area, um, so we'll provide some updates, uh, as the range and the Astra teams work that issue. Um, in the meantime, we'll happily take some more questions. So again, if you've got question on today's mission, please t- s- with @NASASpaceFlight and we'll try to bring as many of those in as we can. We are keeping an eye on the weather as this hold continues. Um, hoping to get this resolved as quickly as possible, of course. Uh, but let's see what other questions we have.
Thomas Burghardt (00:25:43):

Um, here's a good question. Uh, [inaudible 00:25:46], "Is there any particular reason that this hold is happening at the f- exactly at the 15 minute mark, or is that just kind of a convenient time?" No particular reason. Uh, we'll keep providing some more updates as we have them. Uh, but again, if you have any questions, please tag @NASASpaceFlight in chat. Uh, in the meantime, let's go ahead and listen into the pad microphones as the teams work this issue. And again, we're gonna wait for another update as we have them.
Speaker 3 (00:29:18):

This is Astra [inaudible 00:29:19] countdown. We have cleared the final clear to launch hold. UT zero is 16:12 UTC. Step 80, tango, in AV1, manage power systems. Toggle ground power system authority to true.
Speaker 6 (00:29:31):

Ground power system authority, true.
Speaker 3 (00:29:35):

And AV1, manage pulling, toggle do both ground and guidance pulling to true.
Speaker 6 (00:29:39):

[inaudible 00:29:39] Both ground and guidance true.
Speaker 3 (00:29:41):

GNC, do you require an additional self-test at this time?
Speaker 8 (00:29:45):

Yes, please.
Speaker 3 (00:29:46):

In VB1, turn on off PDBs. Tango, please toggle GNC self-test to true. GNC, call out upon completion.
Speaker 8 (00:29:53):

[inaudible 00:29:53].
Speaker 6 (00:29:54):

GNC self-test [inaudible 00:29:55].

PART 1 OF 5 ENDS [00:30:04]

Thomas Burghardt (00:30:00):

TAT self test passed.
Speaker 9 (00:30:42):

Copy. FTS team confirm that the FTS is still enabled.
Speaker 10 (00:30:52):

[inaudible 00:30:52] can confirm.
Speaker 9 (00:30:53):

Copy. Tango in fuel four operate. Please toggle full and fast to true.
Speaker 11 (00:30:59):

Four operate. Full. True.
Speaker 10 (00:31:04):

Got you.
Thomas Burghardt (00:31:15):

All right. So as you may have just heard, we have a new T-Zero. The countdown has resumed. Just under 11 minutes to go. The new T-Zero is 9:12 AM Pacific Time, or 12:12 PM Eastern Time. 16:12, UTC. The range has cleared that boat in the hazard area, and everything now on track for launch in just under 11 minutes.
Thomas Burghardt (00:31:34):

Um, so we should be now coming up on the go/ no go poll for today's flight. So let's go ahead and listen in to the count at it, as the teams work through the final 10 minutes of the count.
Speaker 11 (00:31:47):

Currently non idle.
Speaker 9 (00:31:49):

Please set the idle.
Speaker 11 (00:31:50):

Setting to idle.
Speaker 11 (00:31:59):

Idle.
Speaker 9 (00:31:59):

Pleas- please set fuel four operate to idle. Or, sorry. Standby on that one.
Speaker 9 (00:32:06):

Please make sure pump battery two manage pump battery charges in idle.
Speaker 9 (00:33:14):

Go. Tango in zero, machine activator toggle launch machines to true.
Speaker 11 (00:33:19):

S-, zero machine activator, launch machines to true.
Speaker 9 (00:33:29):

Tango, activate launch machine.
Speaker 11 (00:33:35):

Launch machine is active.
Speaker 9 (00:33:36):

Toggle locks topping to true.
Speaker 11 (00:33:38):

Locks topping, true.
Speaker 9 (00:33:41):

This takes us to step 90. This is the poll for tank pressurization and launch.
Speaker 9 (00:33:47):

Payload, please conf-, -cerm, confirm there are no concerns for flight and that the payload is ready.
Thomas Burghardt (00:33:54):

Payload ready.
Speaker 9 (00:33:56):

Copy.
Speaker 9 (00:33:57):

Astra team, after this point, any system issue must be called as a hold, hold, hold on the countdown net. If there are no concerns for flight, call go. Otherwise, no go. Red lead.
Speaker 12 (00:34:08):

Red lead is go.
Speaker 9 (00:34:09):

FTS.
Speaker 13 (00:34:10):

FTS is go.
Speaker 9 (00:34:10):

GNC.
Speaker 13 (00:34:11):

GNC is go.
Speaker 9 (00:34:12):

Athena.
Speaker 14 (00:34:14):

Go.
Speaker 9 (00:34:14):

FAO.
Speaker 9 (00:34:16):

FAO is go. CVH.
Speaker 15 (00:34:17):

CVH is go.
Speaker 9 (00:34:18):

Tango.
Speaker 11 (00:34:19):

Tango is go.
Speaker 9 (00:34:20):

Astra safety.
Speaker 10 (00:34:21):

Safety is go.
Speaker 9 (00:34:22):

Flight is also go.
Speaker 9 (00:34:28):

Tango, verify that the vehicle still looks ready for launch aside from tank press and final topping.
Speaker 11 (00:34:34):

Confirmed. All CCs are met.
Thomas Burghardt (00:34:35):

All right, so the teams have pulled go for today's launch attempt. Under seven minutes to go. Really quick, let's go ahead and preview what we're expecting to see in just under seven minutes. Amanda?
Amanda (00:35:17):

Yeah, so at T-Zero, the first stage engines will fire at the full 32,500 pound thrust to start LV0010's journey toward space. Uh, just six seconds into the flight, the onboard guidance will start to pitch the vehicle over towards it's orbital trajectory. And just over one minute into flight is where the vehicle will reach Max Q. This is a really important milestone that tests the structural integrity of the first stage body during flight. Uh, it is the period of maximum aerodynamic loan on the vehicle.
Amanda (00:35:44):

At the three minute mark, we will have reached Main Engine Cut-off, or MECO, as it will be called out. Um, which is where the first stage engines will receive the command to shut down, allowing the vehicle to briefly coast before stage separation.
Amanda (00:35:57):

From there, we have a series of three closely timed events. The fairings will pop open and fall away from the vehicle, immediately followed by stage separation, which is when the first stage releases the upper stage into atmosphere and concludes the first stage milestones for the flight. And just around three minute, fifteen seconds, the upper stage engine will ignite and be on it's way to delivering our customer's payload's orbit.
Amanda (00:36:18):

After a roughly five minute flight, the upper stage will receive the command to shut down it's engine, followed by payload deployment. As I mentioned earlier, we are hoping to see one of the two payloads being deployed through the upper stage onboard cameras, however it is possible that it can take up to 90 minutes or a couple of orbits of the satellites in order to have this confirmed. And that is entirely foreseen, this is due to the nature of the groundlings relative to the satellite's location in orbit once the deployment occurs.
Amanda (00:36:47):

Uh, so we will be ending the live stream broadcast as soon as deployment happens, um, and likely before the satellite communication has been confirmed. Uh, but please remember to follow NASA's twitter handle, @NASAEarth, for confirmation once the satellite communication's been received. And we will also provide an update of our handle, @Astra, when we have confirmed with our NASA partners.
Thomas Burghardt (00:37:07):

Awesome, and at T-Minus 5 minutes and counting. We also should r-, quickly just acknowledge that the new mission control look, which may have looked different from last time...
Amanda (00:37:14):

Mm-hmm.
Thomas Burghardt (00:37:14):

Uh, Amanda, do you want to talk a little bit about why mission control here in Alameda looks a little different today?
Amanda (00:37:18):

Yeah, so our mission control has gotten an upgrade. Um, par-, a lot of that is trying to improve our operational efficiency and streamline our process. As it used to take, you know, six plus team members, and now we've gotten that down to our four t-, uh, key team members, uh, in the mission control pod. And these pods are portable as well, so we can perform mission control from anywhere, uh, that we need to.
Thomas Burghardt (00:37:38):

That's awesome.
Thomas Burghardt (00:37:41):

So, about four and a half minutes to go here, and everything appears on track for launch. So with that, let's go ahead and listen in to the countdown, and we'll listen to the teams go through the final steps for launch. Of course, myself and Amanda will provide any updates as we have them, but let's listen in as the first TROPICS flight approaches liftoff.
Speaker 9 (00:38:07):

Four minutes.
Speaker 9 (00:38:27):

Rock, flight on countdown.
Speaker 16 (00:38:28):

Rock.
Speaker 9 (00:38:29):

First of 94, please verify range is recording telemetry at this time.
Speaker 17 (00:38:33):

Telemetry recorders are running.
Speaker 9 (00:38:35):

Copy. Thank you.
Speaker 9 (00:38:38):

And reminder to control room, if you require RFD, that'd be prepared to switch over your pages at liftoff. Reminder to all that any three word hold from here on out is an immediate abort regardless of source. And MFCO, please be prepared to issue option when rocket IIP marker passes min MECO, and was in, and is within disperse trajectories calling out at event.
Speaker 18 (00:39:39):

MFCO copies.
Speaker 9 (00:39:46):

ACE, start PSD recordings and down range ground station recordings at this time.
Speaker 19 (00:39:51):

Will do.
Speaker 9 (00:40:07):

Two minutes.
Thomas Burghardt (00:40:11):

Two minutes and counting, and everything on track so far.
Speaker 9 (00:40:24):

Hold, hold, hold.
Speaker 11 (00:40:27):

Pulling [inaudible 00:40:28].
Thomas Burghardt (00:41:16):

Okay, so as you may have just heard, a hold was cal-, called on the countdown net, so we're going to standby for another update, uh, to see what the issue may, that may, the teams may be working is. We'll provide that update as soon as we have it, but again, the count has entered a hold.
Amanda (00:49:53):

We do have an update for you. We are still holding to complete final locks conditioning. Uh, and so once that is complete, we will likely get a new T-Zero time shortly from mission control for you.
Thomas Burghardt (00:50:04):

Yeah. We'll keep the updates coming, again, as soon as we have them. Everyone holding at T-Minus 31 seconds, expecting a recycle for a new T-Zero shortly. Um, also in the meantime while we wait for that recycle, we'll go ahead and take some more questions.
Thomas Burghardt (00:50:16):

Um, first one off, I'll just start with one on the screen. No, that cruise ship is not violating the range right now. Uh, that ship in the background is not within the protected launch corridor. It's beyond where the rocket sh-, planned trajectory is. So, no worries there. But, feel the need to address that since it's on screen.
Thomas Burghardt (00:50:31):

Uh, but otherwise, we've got some other questions to come in while we wait for this hold to clear. Um, so let's start with, um, this one here. Uh, Scribes asked, "What kind of material is the vehicle made out of?" Amanda?
Amanda (00:50:43):

Uh, yeah, so a lot of our first stage structure is made out of aluminum. Uh, we, we try not to have any exotic materials on the vehicle that are difficult to obtain, or hard to machine. Um, that really helps to ensure that the vehicle is scaled for, uh, manufacturability.
Thomas Burghardt (00:51:03):

Got ya. Um, another question from Sergeant Scott is, "How tall is the rocket, and is it heading to orbit today?"
Amanda (00:51:09):

Uh, so the vehicle is 43 feet in length. So, it is able to fit into a standard 45 foot shipping container, which makes it very easy for portability to our various, uh, space ports. Um, and our launch attempts today is, uh, the countdown will be, um, resuming soon. Uh, and so once that happens, our, uh, targeted l-, orbit for this mission is, um, you have to deliver the TROPICS-1 payloads to the 550 kilometer orbit, at again, that 29.75 orbital inclination relative to the equator.

Thomas Burghardt (00:51:43):

Got ya.
Thomas Burghardt (00:51:54):

Yeah, so on the screen here, we could actually see that graphic of the planned launch trajectory. It's pretty much due east out of Cape Canaveral, uh, within that kind of safety corridor. And if we go back to that camera that showed the cruise ship, that's looking south, um, actually towards Port Canaveral, for those of you that live, or have been around the Canaveral area may know what I'm talking about. Um, that is south, whereas the rocket will be flying w-, kind of left out of frame from this view t- to the east.
Thomas Burghardt (00:52:16):

So again, just reiterating that that cruise ship is not anywhere it's not supposed to be, and is not a problem for today's flight. Um, the current hold is to complete final liquid oxygen conditioning on the vehicle. So, waiting for a new T-Zero regarding that as well. Um, but in the meantime, more questions.
Thomas Burghardt (00:52:32):

Uh... We do have a (laughs) funny question here. Musical wolves is a regular in the chat, who says, uh, "Are the mysterious four towers portable for Astra, since the rocket and ground equipment are portable?" I don't think the lightning protection towers are some of the things that Astra ships out, right?
Amanda (00:52:48):

(laughs) Those are not. That is part of the permanent infrastructure at, uh, the space launch complex.
Thomas Burghardt (00:52:55):

Got ya. Always got to ask about the towers though, it's a rule around here.
Amanda (00:52:57):

(laughs)
Thomas Burghardt (00:53:05):

Uh, we do have a quick question here from Dike, who asks, "When does the launch window close?" Today's launch window extends until 2 PM Eastern Time, or 1800 UTC. Um, so we're still well, pretty early in the launch window, and, uh, hoping for a quick recycle and a new T-Zero here shortly. Uh, while we wait for another update on this hold... Again, hoping that it'll clear soon, but we're going to go ahead and take a break and wait for another update. We'll provide that as soon as we have it.

PART 2 OF 5 ENDS [01:00:04]

Thomas Burghardt (01:01:53):

Okay, so as you see, we're still holding here. We're waiting for this hold to be resolved, but Amanda, I do believe we have an update regarding the weather for today's attempt?
Amanda (01:01:59):

Yeah. So we have recently heard from the range that we are good for another 20 minutes. After then, the weather will, uh, become, uh, too difficult for us to be able to, uh, likely proceed with today's launch.
Thomas Burghardt (01:02:10):

So yeah. So we'll keep an eye on that, but it looks like we've got at least another 20 minutes to go. Um, so hopefully, if this recycle can occur a little bit quickly, well, you should still have another chance to launch today. So again, keeping an eye on that, and we'll provide more updates as we have them as they continue to work this launch conditioning issue. In the meantime, I think the audio cut out earlier. So I wanna ask this question again, earlier we had that hold at T minus 15 minutes. Do you wanna talk a little bit about why that was the whole point?
Amanda (01:02:33):

Right. Yeah. So the T minus 15 mark is when we enter our terminal count and it... That is a really important milestone. Um, that's when we can start to transfer the control over to the vehicle, uh, it's also where we would likely revert back to in case of a recycle. Um, and another key milestone is at approximately 10 minutes from liftoff where we perform, uh, the go-pole for lunch and take prensur- tank pressurization. Um, and then at six minutes is when the range provides the authorization to launch.
Thomas Burghardt (01:03:02):

Gotcha. So while we're waiting for this hold, if you are just joining us, this is the live coverage of the TROPICS-1 Mission on Astra's LV0010 vehicle. Amanda, do you want to just give a brief overview for the new people that may just be tuning in about what today's mission's all about?
Amanda (01:03:17):

Right. Uh, yeah. So this mission marks, again, our second mission with NASA, um, and we are launching... It's the first of three launches to deliver the NASA TROPICS satellites, uh, to lower earth orbit. Um, and so the objective for today, uh, is to deliver the two identical cube sets to an orbit of 550 kilometers at a 29.75 degree inclination. Um, these payloads are about 3U in size. Uh, so they are fairly small. Um, and the payloads, uh, are used to monitor the weather of incoming storms. Um, and so the imagery will actually penetrate into a storm cloud layer and be able to

provide, uh, precipitation, temperature, and humidity data measurements for scientists meteorologists to help understand how storms form grow and intensify throughout their life cycle.
Amanda (01:04:08):

Um, and then we do have, uh, uh, a great blog, um, that NASA has provided for us. You can find that with a more overview of the, uh, satellites themselves. You can find that at astra.com/mission/tropic-1.
Thomas Burghardt (01:04:21):

All right. And while we wait again for more mission updates, we have a couple more questions coming into the chat here. So we'll go ahead. Um, and we have one asking about the space ports that Astra operates out. Of course, this is Cape Canaveral, not the first time Astra's launched from here. Astra has also launched from Kodiak in the past. Can you talk a little bit about, uh, the differences in those space ports and where else Astra might begin launching from?
Amanda (01:04:45):

Uh, yeah. So, uh, we... The two main space ports that we launch out of right now are Kodiak, Alaska and Cape Canaveral. Um, so Kodiak is beneficial because it is a commercial launch site for both orbital and sub orbital vehicles. Um, and then we did actually recently announce a partnership in may with SaxaVord in UK spaceport. You can learn more about, uh, that partnership astra.com, and also our video recording from our space tech day. Uh, so we're very excited about this partnership as it would expand our capacity to reach key inclinations.
Thomas Burghardt (01:05:15):

Gotcha. And speaking of other locations regarding Astra, where was this rocket built?
Amanda (01:05:21):

This rocket was built right here at our headquarter factory in Alameda, California.
Thomas Burghardt (01:05:27):

It shipped to via road all the way to Florida, right?
Amanda (01:05:29):

Yep. This one went, this one, uh, rolled via truck.
Thomas Burghardt (01:05:35):

I believe we actually have a video of that arrival if we can show that. This is the video of the rocket being shipped out to Florida for today's launch. So again, that's how the rocket got here. And of course, there was a static fire test prior to the launch attempt. And today's launch attempt is currently in a hold. We're waiting for another update on this launch's conditioning issue. Uh, once that hold clears, there'll be a recycle point and a new T zero. Um, so once we get a little bit more information and an update on that, we'll go ahead and come back. But let's go ahead and take a break, and we will come back to you with more information as soon as we have it. Again, stick with us.
Thomas Burghardt (01:06:39):

(silence) All right. So we are still in a hold here at, uh, T minus 31 seconds expecting a recycle and a new T zero, hopefully before too long. The window does last all the way till 2:00 o'clock PM Eastern time, 18:00 UTC, and we're keeping an eye on the weather with regards to that as well. But still holding for an update, uh, hoping for another recycle still, excuse me. But, uh, in the meantime, we do have some more questions coming in. So, uh, first off Amanda, how much thrust does Rocket 3 have, and what's the thrust weight ratio with that?
Amanda (01:15:19):

Uh, yeah. So the overall thrust of the first stage vehicle is 32,500 pounds. Uh, so there are five, uh, first stage engines on our engine bay. And each one of those deliver about 6,500 pounds of thrust individually, and there's 740 pounds on the upper stage.
Thomas Burghardt (01:15:37):

Gotcha. Um, and that thrust again, we talked about earlier about the, uh, fuel combination of RPX kerosene and liquid oxygen. Uh, Martin is asking is the rocket propellant, uh, the kerosene, uh, component not cooled 'cause you could see only the liquid oxygen tank is frosty there.
Amanda (01:15:51):

Right. Yep. No, the, the, uh, kerosene is not cool. That is at atmospheric conditions.
Thomas Burghardt (01:15:56):

Gotcha. Uh, another question here, uh, what is the payload capacity of Rocket 3?
Amanda (01:16:02):

Yeah. So Rocket 3 is able to deliver anywhere from 25 to 150 kilograms of payload up to a 500 kilometer sun synchronous orbit.
Thomas Burghardt (01:16:11):

Gotcha. And again, the rocket, uh, for today's launch still in a hold. We're gonna provide another update again, as soon as we have it, but the teams are hoping to recycle. Um, so keep those questions coming in the meantime. Go ahead and tag us at NASA Space Flight in chat. Um, we're gonna keep looking for some more questions, uh, while we wait for another update as well, and we'll come back as soon as we have it.
Thomas Burghardt (01:17:42):

(silence) All right. So we are still waiting for an update on today's countdown. Again, we'll provide that update as soon as we have it. Uh, in the meantime, let's go ahead and take a look at this overview video about the NASA tropics mission and partnership with Astra.

TROPICS video

Martin Attiq (01:26:01):

A peer research poll showed that of nine different categories that NASA should focus on, number one on the list is to observe the Earth's climate. The TROPICS mission is a mission that Americans really care about because it is directly observing our climate.
Dr. William J. Blackwell (01:26:15):

TROPICS has a very specific need for their overall configuration. We need to go to a 30 degree inclined orbit, and no one else really wants to go there. The ride shares are all going to sun synchronous orbits, or mid inclinations. So it's very well-targeted to a, uh, smaller vehicle with a very targeted insertion where they can get us exactly where we want to go. And Astra is perfect for that.
Martin Attiq (01:26:34):

And so being able to launch three different times for $8 million is unprecedented. Because of our unique ability to get to three different orbital in a very short period of time at a low cost.
Chris Kemp (01:26:46):

Why I'm excited about TROPICS is coming out of NASA having the opportunity to fly satellites, uh, for the organization I used to work for is, is personally gratifying for me. It's also a really important mission because we can detect tropical storms, we can help people evacuate, we can save lives. And it's a mission that's really well-designed for Astra's capability, being able to put multiple rockets up into multiple planes rapidly.
Hemant Chaurasia (01:27:12):

And we have the honor of being the final and most important piece at this moment in time of their mission, which is get that hardware in space exactly where it needs to go. We see that there are increasingly smaller satellites that are smarter, that are doing cool things in orbit, but they need to go to particular destinations at particular times.
Dr. William J. Blackwell (01:27:30):

The real end game here is improving our ability to forecast tropical cyclones. What we're trying to do is make measurements in the microwave wavelength region, and those have the advantage of being able to penetrate the cloud tops and see the storm thermodynamics underneath the clouds. We're gonna get something we've never had before in the history of weather satellites, which is revisit rates of better than one hour.
Chris Hofmann (01:27:52):

For the team itself, just this will be a massive culmination of the last three years of work of developing this launch system to be able to do these things that we set out to do from the very beginning.
Dr. Adam London (01:28:03):

From Astra's perspective, it's really important because we believe in space at scale, and to do that, you need to have much more frequent launches and access to space. And so this has been an opportunity for us to really understand how can we further compress the turnaround time between launches, both in terms of building the rockets in and conducting the launches.
Martin Attiq (01:28:28):

What this milestone means for us is delivering a really important mission for our customer, but also demonstrating the capability that others can leverage in the future.
Chris Hofmann (01:28:38):

And so the opportunity to be a part of something like TROPICS, where you get to make a difference and make a really large impact in the lives of people and help humanity as a whole does mean a lot to me. And it really excites me as well, going into this mission, knowing that we can help do something to make the world a better, safer place for people.
Thomas Burghardt (01:28:55):

All right, everyone. Again, we're still waiting for an update on today's countdown. The window does last again till 2:00 o'clock PM Eastern Time, our 18:00 UTC. So we'll provide updates as we have it. There is still time left in the window, and the teams are continuing to work to resolve this hold. So stand by for and update as soon as we have it.

Thomas Burghardt (01:36:40):

All right everyone. Thank you for your patience and sticking with us. We'll keep providing an up- we'll provide another update again as soon as we have it. Right now teams are just still working to resolve this hold in the window that, again, lasts for another hour. So plenty of time in the window but standing by for another update and we'll provide that and a new T-Zero as soon as we have it.
Thomas Burghardt (01:36:58):

In the meantime we do have a couple more question that we can go through here. So, let's see, uh, if today is scrubbed, when is the next likely launch window, Amanda?
Speaker 20 (01:37:06):

Ah, yeah, we do have one more day in our launch window, which is tomorrow, Monday, June 13th.
Thomas Burghardt (01:37:11):

Right, and we're not- again, we're not push to that just yet, but there is a backup opportunity tomorrow. Um, for tomorrow, ah, does the weather look, ah, favorable for tomorrow's attempt?
Speaker 20 (01:37:20):

Ah right now, it does look like the weather is actually more favorable than it is today.
Thomas Burghardt (01:37:22):

Got it. The weather still kind of holding out for today.
Speaker 20 (01:37:25):

Mm-hmm.
Thomas Burghardt (01:37:25):

So we- we're gonna keep an eye on that. But, um, and an-another attempt with favorable weather forecast tomorrow. So, again, provide that update as soon as we have it. Um, other questions here. We did have a question earlier, we were talking about how the teams were working on launch conditioning, can you actually elaborate on what that means, and what- what- what's, ah, you know, wha- wha- what they were might have been working on, with regards to launch conditioning?
Speaker 20 (01:37:46):

Right, so, that's part of our propellant loading procedure. Ah, it's filling up the liquid oxygen into the, uh, liquid oxygen tank. Um, as the vehicle is sitting on the pad, obviously, is- it is a cryogenic fluid, um, you know, that fluid is boiling off, um, and so as it sits there, we do need to top off the tank. So, we can- need to continue to continuously ah, refill the liquid oxygen as the vehicle is sitting on the pad, pro-prior to launch.
Thomas Burghardt (01:38:09):

Got it. Uh, another question here from Kanes, who asked, "Is Astra hiring?" I believe that's a great question for you, right now [inaudible 01:38:16].
Speaker 20 (01:38:16):

(laughs) It is. Yeah, Ash- Astra is hiring. Um, please check out our website, uh, for the over 100 different posting that we're currently recruiting for. Um, and we have an amazing recruiting team. So, please reach out to any of them. We'd be more than happy to share with you all of the opportunities that, uh, Astra has to offer. Um, I personally spent 11 years in the aerospace industry, in test geoengineering before I took the, uh, huge step, uh, to join the operations team here at Astra. And it really has been one of the most rewarding experiences. Uh, sending rockets to space is hard, as you can see. And this team works really hard but they take care of each other. Uh, and we aim to give everyone ownership and autonomy over their projects. Uh, so, come work on something amazing with us. You know, we're looking for mechanical engineers, technical engineers, test engineers, fluids engineers, anyone with experience is valves, or automation, uh, or even software systems help us design uh, our next rocket. And we're also looking to scale up our team in the operations department, as well, to help us build and qualify each of these vehicles as it leaves the building. So, looking for production supervisors, production managers, as well as build technicians. So, please check out our website at Astra.com/careers.
Thomas Burghardt (01:39:25):

Awesome. Some other questions we're getting here and we have one question about are, "Have there been any major changes since the last launch from LV0009?"
Speaker 20 (01:39:32):

Um, so we are continuously seeking to improve the functionality, uh, and reliability, uh, of the vehicle. So, there have been some minor software updates, uh, that have been implemented on LV0010. But, there have not been any major material or mechanical grades to the vehicle, uh, since LV0009. Um, we do have the remainder of our TROPICS vehicles currently in work on the production floor. Um, they're actually directly behind us right now-
Thomas Burghardt (01:39:57):

Mm-hmm.
Speaker 20 (01:39:57):

Is the final integration lane and so our team, our team is actually working to transition away from Rocket 3 and towards our Rocket 4. So, we did see a question, ah, in there about the progress of that. So, we are at a transition point right now for our production floor, as we're ramping down our Rocket 3 production efforts, and building in more of those development builds for Rocket 4.
Thomas Burghardt (01:40:19):

Nice. See, another question we had was, "How long before the launch does the fueling take place?" 'Cause of course when we go live, you guys just see, propellant loading has already been well under way. So, how long before launch does Astra start fueling their rocket?
Speaker 20 (01:40:32):

Yeah, so it typically takes about two hours to start the fueling process from, uh, from beginning to when the vehicle is ready to go, and sometimes if we do need to recycle, it can often take up to 30 minutes, uh, to recycle the- the vehicle.
Thomas Burghardt (01:40:46):

Gotcha. In regards to that ground supported equipment that is of course, involved with fueling and all these other things. Um, can you talk a little bit about how that ground supported equipment gets transported, along with the rocket to the launch site?
Speaker 20 (01:40:58):

Yeah, so the amount of ground support equipment that goes with each of the vehicles depends on where were launching from, and what type of infrastructure we already have set up in the area. So if it's Kodiak, Alaska, or the Cape, then we have, uh, you know, some of the ground support equipment that is left there from our previous launches. But if we were to set up brand new at a new pl- at a new location, um, believe we can bring all of our ground support equipment in, in roughly five containers. Un, and that includes, you know, our consumables, uh, the helium [inaudible 01:41:27] containers, our pro- our fuel, brings- uh, brings in the- the Cube, and even, um, the Cube for the launcher system, and the rocket, and then we also have a clean room that we bring among in a... in a shipping container. So, roughly around five shipping container is what we need to set up a new space.
Thomas Burghardt (01:41:42):

Five shipping containers for an orbital launch system, that's- that's pretty cool.
Speaker 20 (01:41:45):

(laughs)
Thomas Burghardt (01:41:53):

Again, everyone, if you just stick with us, we are waiting for another update on today's countdown, still in a hold right now. Uh, the window lasts until two 'clock pm Eastern time, and we will provide another update, agan, as soon as we have it. The team's still working on resolving that hold. Uh, but, uh, keep the questions coming, tag us @nasaspaceflight and chat, and then we'll come back with some more updates and some more questions and answers, uh, once we have them.
Thomas Burghardt (01:57:17):

Uh, go ahead [inaudible 01:57:18].
Speaker 20 (01:57:18):

(laughs) We do have an update for you. Ah, we are going to finish our configuration loads and checks, and do a terminal count pre-poll, and we'll be checking back in with the range to see if they are go, or no go. It does appear that the weather is favorable until at least 10:45 am Pacific.
Thomas Burghardt (01:57:36):

Yeah, so that Florida weather doing the Florida weather thing.
Speaker 20 (01:57:39):

Yes.
Thomas Burghardt (01:57:39):

[inaudible 01:57:39] might just hold out long enough. So, we'll keep an eye out on that. But sounds like we are getting close to a new T-Zero, so stay tuned for that. Um, in the meantime, we do have a couple more questions to go through, so we'll keep those coming with that update. Uh, first question from Hoppy is, "What is the expected time for launch tomorrow? I have exams and don't want to miss the launch."
Speaker 20 (01:57:56):

(laughs)
Thomas Burghardt (01:57:56):

I can relate to that. But what is the launch window for tomorrow?
Speaker 20 (01:57:58):

So the launch window for tomorrow would be at the same time as it was today. Uh, so that would be starting at 9:00 am Pacific, 12:00 pm Easter.
Thomas Burghardt (01:58:05):

Gotcha. But hoping that we don't need that because it sounds like we might get lucky today. We'll stay tuned for that. Um, other questions coming in here? Uh, GamingViper asks, uh, "What engines are being used for this rocket?" So, what are the engines on Rocket 3.
Speaker 20 (01:58:18):

Right. So the Rocket 3 engine, ah, so on the fist stage, ah, there are the five, um, electric pump fed engines. Uh, each one has 65,0000 pounds of thrust. Un, so those are fed via the RPX, [inaudible 01:58:34], highly reformed- refined form of kerosine, as well as liquid oxygen. Um, so there's a total combined thrust of 23,500 pounds on the first stage engine bay. Um, and there is one engine on the upper stage, and that is a pressure-fed engine, that can provide 740 pounds of thrust.
Thomas Burghardt (01:58:50):

Gotcha. And then you mentioned earlier, we were talking about the new mission control set up, that's still here in Alameda, right?
Speaker 20 (01:58:58):

Yes. Yep, yeah, so even though thi- this pod is portable, the intention is for mission con- control to stay here in Alameda, rather than actually transporting these pods to the launch site. Mission control is intended to be at headquarters. However, we do have our smaller team that does head out to the launch site, that is our red team. Uh, so the intention is to make sure we have two small teams supporting each of the launches. One that does travel to the launch site, but then also the mission control pod staying here and supporting on-site he- headquarters.
Thomas Burghardt (01:59:26):

Yeah, gotcha. So, again, the launch site out there in Cape Canaveral, Florida, if you are just joining us, this is live coverage of the LV0010 Launch Vehicle, which is slated to launch the TROPICS-1 mission, the first of three flights for NASA's TROPICS mission, uh, from Cape Canaveral, Florida. Right now the teams are in a hold but they're working on resolving it with some last minute checks and things. Sounds like we should get a new T-Zero, hopefully very soon. The window lasts until 2:00 pm Eastern, and weather is continuing to corporate. Maybe just long enough for our launch today. But we're gonna stay tuned for another update. And we'll provide T-Zero as soon as we ha-

PART 4 OF 5 ENDS [02:00:04]

Thomas Burghardt (02:00:00):

... [inaudible 02:00:00], uh, but we're gonna stay tuned for another update. We'll provide that T-0 as soon as we have it, so stay with us.
Speaker 9 (02:00:23):

Okay, Tango, can you confirm for me that an AV1-managed power systems toggle ground power systems authority is still true?
Speaker 21 (02:00:34):

Uh, Tango on countdown. AV1-managed power systems authority, uh, ground power systems authority is true.
Speaker 9 (02:00:41):

AV1-managed polling, do both ground and guidance polling is set to true?
Speaker 21 (02:00:47):

Setting both ground and guidance polling to true.
Speaker 9 (02:00:52):

GNC...
Thomas Burghardt (02:00:54):

All right, so as you can see now, the countdown clock has resumed. It's just about T-12 minutes and counting. We're gonna come up on another go/no go poll, like we heard earlier. Um, the teams are back into a recycle and aiming for a new T-0 of 10:43 AM Pacific Time. That's 1:43 PM Eastern time, local time in Cape Canaveral, or 17:43 UTC. Again, now just under T-12 minutes, and the teams are tracking towards a new T-0 for today's launch.
Thomas Burghardt (02:01:22):

Really quickly, we can do a brief overview of the mission timeline again, if you are just joining us, this is what we would expect to see after the last 10 minutes of this countdown, so, Amanda?
Amanda (02:01:31):

Yeah, so T-0 is when we have, uh, first engine ignition and liftoff. Um, and then just six seconds into the flight is when we begin our pitchover, which is when the onboard guidance will start to pitch the vehicle over towards its, uh, downrange orbital trajectory. And then, just over on minute over into flight is when the vehicle will reach Max-Q. Um, again, this is when, uh, the vehicle's structural integrity will be tested, um, because this is when, uh, the [inaudible 02:01:57] maximum, uh, dynamic pressure on the, on the vehicle during flight.

Amanda (02:02:02):

Um, then just at the three minute mark is when we will have reached Main Engine Cut-off, or MECO as it will be called out. Um, and this is when the first stage engine sh-, engines will received the command to shutdown, which allow the vehicle to briefly coast before stage separation. Uh, from there, we will receive the command to have the fairings pop open and fall away from the vehicle, um, which will then be followed immediately by stage separation. And so, that is when the first stage releases the upper stage, uh, into the atmosphere. And then, at around three minutes fifteen seconds, the upper stage engine will ignite and be on its way to orbit. And then, after a roughly five minute flight, uh, the upper stage will receive the command to shut down its engine, followed by payload deployment. Um, and as we mentioned earlier in the livestream, we are hoping to see live video feed from one of our onboard upper stage cameras of one of the two payloads being deployed. However, uh, it is possible that we will not see confirmation of this for up to 90 minutes after the satellite deployment. Um, or at least a couple of orbits. And that is mostly due to the location of the satellites in their orbit relative to their ground communication links once deployment happens.
Amanda (02:03:11):

Uh, so, we will be ending the livestream right as deployment occurs, but again, the satellite communication may not be confirmed for up to 90 minutes. Uh, so, please remember to follow NASA's Twitter handle, uh, @NASAEarth, who will provide confirmation once, uh, that satellite signal confir-, is confirmed. Um, and then we will also provide an update on our handle @ Astra when we have confirmed, uh, with our NASA partners.
Thomas Burghardt (02:03:34):

As the teams get ready to go to the last few minutes of the countdown, let's go ahead and listened in as they go through the final go/no go poll.
Speaker 9 (02:04:00):

Okay, team. This is, takes us to step 90. Hold three for tank press and launch. Customer, can you please confirm if the payload is ready for flight?
Customer (02:04:14):

Payload ready.
Speaker 9 (02:04:16):

Copy. Going around the room, team. After this point, any system issue is a three-word hold on the countdown net. If there are no concerns for flight, call go, otherwise call no go. Red lead.
Speaker 22 (02:04:28):

Go.
Speaker 9 (02:04:28):

FTS.
Speaker 23 (02:04:29):

Go.
Speaker 9 (02:04:30):

G&C.
Speaker 24 (02:04:31):

Go.
Speaker 9 (02:04:31):

Athena.
Speaker 25 (02:04:32):

Athena is go.
Speaker 9 (02:04:33):

FAO.
Speaker 26 (02:04:34):

FAO is go.
Speaker 9 (02:04:35):

CDH.
Speaker 27 (02:04:36):

CDH is go.
Speaker 9 (02:04:36):

Tango.
Speaker 21 (02:04:36):

Tango is go.

Speaker 9 (02:04:38):

Astra safety.
Speaker 28 (02:04:39):

Safety is go.
Speaker 9 (02:04:41):

Astra flight is also go.
Thomas Burghardt (02:04:49):

All right, as you just heard, the teams have once again polled go for launch. Uh, T-8 minutes and counting. You could see right now, that's the mission control team. Amanda, you wanna give us an overview of the personnel that are supporting today's launch?
Amanda (02:05:02):

Uh, yeah. So, in the mission control pod, uh, you see, they're sitting here at our headquarters in Alameda. Um, so, in the bottom left hand side of the screen there, you see Joshua Green. He is our controller, also the call-sign Tango. Uh, his responsibilities are executing commands that are being called out for the ground support equipment, as well as the rocket and automation, and also just make sure that all the clicks in actuation are running properly.
Amanda (02:05:25):

On the bottom right hand side of the screen there is Jarrett Bullion. He is our command and data handling, or call-sign CDH. Uh, and his responsibilities are just debugging some of the automation, monitoring progress, and looking for any anomalies in the launch system.
Amanda (02:05:39):

In the back right there is our assistant flight director for today. He is training. Uh, that is Derek Hamilton. He is hidden behind his monitors right now. Um, but then, uh, on the far left is Chris Hofmann. He is our flight director for today. He leads the launch operations procedures, and is ultimately our final launch authority.
Amanda (02:05:57):

Um, in addition to the launch operations team, we do also have an engineering backroom, uh, that helps to monitor the rocket, update software, and perform other various task during operations. These are generally the engineers that are responsible for the system elements, um, and they're, they are there to ensure that things are working properly, and to assist the launch operation team when troubleshooting if needed. Uh, and these folks are scattered across their facility at their own consoles.
Amanda (02:06:22):

Uh, so, huge thank you to this team, launch operations is a multi-day effort with many checkouts and procedures that need to go perfectly in order to give our team the okay to launch.
Thomas Burghardt (02:06:36):

I believe also, in addition to those here in Alameda, you do wanna go over the folks that are out at the launch site for today's mission.
Amanda (02:06:42):

Yeah, so we also have our red team. Uh, the red team are the folks on the ground in Cape Canaveral. Uh, these are the field engineers that travel with the rocket, and they provide onsite support during the delivery, the setup, and all of the final pre-launch preparations for the vehicle. They're basically responsible for all of the physical work that needs to be done on the vehicle after production has officially handed off the vehicle and launch system to launch operations. Uh, so basically find and debug all the mechanical problems.
Amanda (02:07:09):

Uh, so Adam Fish is our red lead. He is the pad leader that has the final say on the things at the pad itself, and leads the activities at the launch site. Then our have our red two through four members. Uh, it's Eric, uh, Larsen, Cory Biels, and Benjamin Barrow. And they're responsible for just doing a lot of the assembling and troubleshooting of the mechanical and electrical tasks at the launch site.
Amanda (02:07:29):

Uh, and then we have Melissa Cornelius, who is our Astra safety officer. Uh, their responsibility is ensuring a safe launch, uh, so that requires a lot of coordination between the range, FAA, and internal Astra personnel. And then we have Eric Steinberg, aka Steiny as our red IT. He is our onsite IT and network professional, uh, basically ensures that our cameras, communication, and data at the launch site, uh, is working. And, as we mentioned earlier about hiring, there are positions on our careers site for launch field technicians. If anyone is interested in traveling to our sites and helping us assist with, uh, our launches.
Thomas Burghardt (02:08:02):

All right. So, coming up on the T-5 minutes mark. We're gonna go ahead and listen in to the mission controllers as they work through the final few minutes of the countdown. Again, if you are just joining us, we are five minutes away from the next launch attempt for TROPICS Flight One on Astra LV0010. Let's listen in.

Speaker 9 (02:09:07):

Four minutes.
Thomas Burghardt (02:09:13):

T-4 minutes and counting.
Speaker 9 (02:09:33):

Rock flight on countdown.
Speaker 29 (02:09:35):

Rock.
Speaker 9 (02:09:36):

At this time, can you verify range has restarted telemetry recordings?
Speaker 29 (02:09:40):

Telemetry recorders are running.
Thomas Burghardt (02:09:43):

Can see some of the teams here at Alameda gathering to watch today's launch.
Speaker 9 (02:09:46):

[inaudible 02:09:46] control room, if you require RF data inflight, be prepared to switch over your pagers. MIFCO, flight on countdown. Please be prepared to issue option on rocket IIP marker, passes min-MECO marker, and is it within disperse trajectories calling out at event?
Speaker 30 (02:10:13):

MIFCO [inaudible 02:10:14].
Speaker 9 (02:10:27):

Reminder all that any three-word halt call from here on out will be onboard.
Speaker 9 (02:10:37):

Ace, please start PSD recordings and downrange ground station recordings.
Speaker 31 (02:10:44):

Done.
Speaker 9 (02:10:44):

Two minutes.
Thomas Burghardt (02:11:09):

T-2 minutes, all systems go so far.
Speaker 9 (02:11:11):

90 seconds. 60 seconds. Vehicle is on internal control.
Thomas Burghardt (02:12:11):

Less than a minute to go. Everything looks on track.
Speaker 9 (02:12:22):

First stage LOX tank coming to liftoff pressure. First stage fuel tank coming to liftoff pressure. 30 seconds.
Speaker 9 (02:12:47):

20.
Speaker 9 (02:12:47):

15.
Speaker 9 (02:12:53):

10, water on.
Speaker 9 (02:12:58):

8, 7, 6, 5, 4...
Amanda (02:12:59):

[inaudible 02:12:59] is launched and is on its way to low-earth orbit for the TROPICS launch mission-
Speaker 9 (02:13:20):

Chamber pressure's nominal.
Amanda (02:13:23):

Our next objective is Max-Q, which is the period of maximum dynamic pressure on the first stage structure during flight, which is coming up just after one minute.
Thomas Burghardt (02:13:37):

There's a tracking shot of the rocket [inaudible 02:13:38] from Cape Canaveral, on its way to space.
Thomas Burghardt (02:13:47):

You can keep track of the mission with the timeline on the bottom, as well as live telemetry on the bottom right of your screen.
Thomas Burghardt (02:13:51):

One minute into flight.
Speaker 32 (02:14:14):

[inaudible 02:14:14].
Thomas Burghardt (02:14:21):

[inaudible 02:14:21] maximum aerodynamic pressure. Now getting some more important views of the rocket, you can see Cape Canaveral below.
Amanda (02:14:46):

Our next milestone is going to be the Main Engine Cut-off, which will be called out by launch ops as we go. Once that option is confirmed, they can [inaudible 02:14:54] shut, set to shutdown the five first stage engines and allow the vehicle to brief coast, to coastly, to briefly coast. We will then signal to pop open the fairings, and allow those to fall away from the vehicle. The first stage will then release upper stage for the final segment of our flight.
Thomas Burghardt (02:15:37):

Two and a half minutes in the flight, again, coming up on Main Engine Cut-off and just about T+3 minutes. Everything looking good so far.
Speaker 30 (02:15:53):

Flight, MIFCO options sent.
Speaker 9 (02:16:04):

Confirmed, option received.
Thomas Burghardt (02:16:10):

Now looking an onboard view, looking up. There you see payload fairing separation. This is a camera on the upper stage. And there is stage separation, and ether ignition. Upper stage ignition. Now the upper stage will burn for just about five minutes on its way to low-earth orbit. Again, everything looking good so far.
Thomas Burghardt (02:16:58):

Can actually see from the onboard telemetry, the vehicle is actually already in space. However, it has to get that horizontal velocity needed to stay in space via achieving low-earth orbit. And so, we're gonna be watching that velocity marker, uh, tick-up on the bottom right of your screen. About four minutes into the flight, everything is looking good so far. You can see on the left there, the path that the rocket has trace so far in its trajectory, pretty much due East right down the center of the corridor. Five minutes into flight, everything looking good. And, we're gonna expect this burn to continue until about eight and a half minutes after liftoff.
Amanda (02:18:27):

Yeah, the eight and a half minute mark, that's when we will receive the Second Engine Cut-off, and at that point will be payload deployment. And, just as a reminder, we, uh, should only be able to see one of the two payloads deploy from this mission from our onboard upper stage camera. However, it is likely that we may not see this video feed, and we may not receive signal confirmation of the satellites, um, for up to 90 minutes after deployment occurs. Again, this is completely expected, and it due to the location of those satellites in orbit relative to their ground communications links.
Thomas Burghardt (02:19:00):

Yeah, we'll have to wait and see exactly, uh, what we see there. But hoping to get some cool views. The teams at Alameda watching on as the flight progresses. Again, the flight going well so far, six minutes into flight. You can keep an eye on that altitude, you can see the rocket already over 510 kilometers in altitude. Again, the target orbit for today is at 550 kilometers of altitude.
Thomas Burghardt (02:20:08):

And you can see also that velocity continuing to climb towards orbital velocity of course, which is good. Seven minutes in the flight. Just a little over a minute left in the planned upper stage burn.
Amanda (02:25:16):

We had a nominal first stage flight. However, the upper stage engine did shut down early, and we did not deliver our payloads to orbit. We will end the broadcast here, and thank you for sticking with us today.
Thomas Burghardt (02:25:28):

Thank you to Astra t-, for partnering with NASA Spaceflight to help bring live launch coverage to you, and stay tuned for more news coverage. But that wraps up our coverage for today. Thank you all for watching.

PART 5 OF 5 ENDS [02:26:40]