

# **Advancing Small Satellite Access to Space for Developers and Launch Providers**

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Mission Manager

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Tyvak Nano-Satellite Systems, Inc.

**CubeSat Developers Workshop**

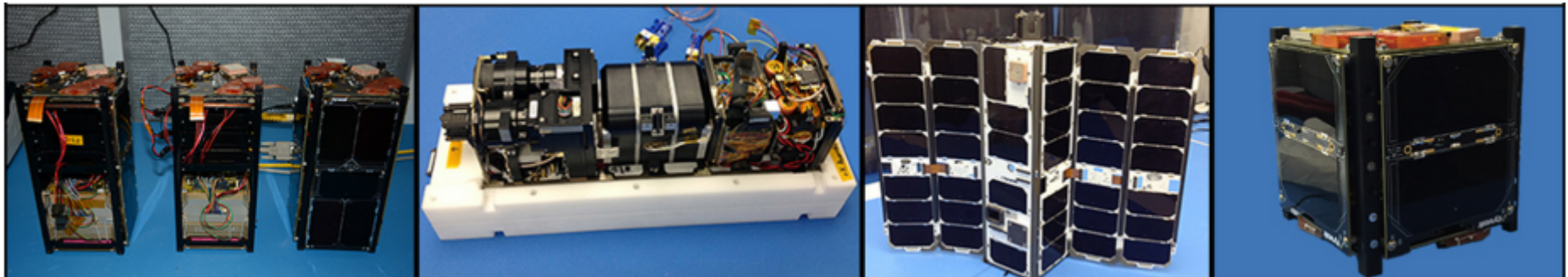
**August 2015**

**Logan, UT, USA**

# Tyvak Company Background and Overview

*Tyvak Nano-Satellite Systems Inc.*

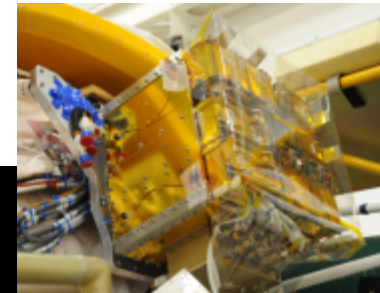
- **Tyvak was created to address unfulfilled and growing CubeSat needs**
  - Advanced “Next Generation” CubeSat Components & Complete Vehicles
  - Provide Complete Program Life-Cycle Expertise and Mission Development
- **Wide range of products and services**
  - From feasibility studies to launch services
- **Quick response and low cost solutions**
  - Focus on value-added work to maintain low operating cost Infrastructure
- **Blend of Creativity and Proven Engineering Expertise**
  - Team experienced in all areas of space business, from CubeSat to large government programs



# Tyvak Launch Services

Tyvak Nano-Satellite Systems Inc.

- Tyvak team benefits from 15 years of launch experience at Cal Poly
  - First launch in 2003
  - Successfully Completed 18 Launch Campaigns
    - 121 CubeSat integrated, 72 Dispensers
    - 10 Different launch vehicles and 9 ranges worldwide
  - 5+ Launch Campaigns Ongoing
    - >40 CubeSats, >25 Deployers



NASA NPP with 3 P-PODs



NROL-39 with 8 P-PODs

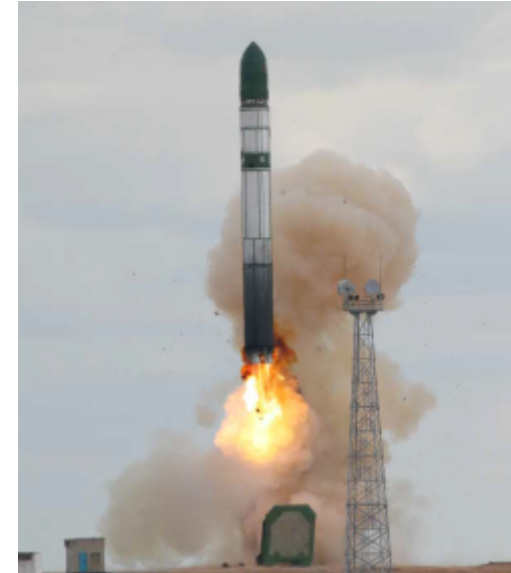


# Integration Flight Heritage Summary

Tyvak Nano-Satellite Systems Inc.

## • Launch Vehicles

- Arianespace Vega
- Eurockot Rocket
- Kosmotras Dnepr
- Orbital Sciences Minotaur 1
- Orbital Sciences Minotaur 4
- Orbital Sciences Taurus XL
- SpaceX Falcon 1
- SpaceX Falcon 9
- ULA Atlas V
- ULA Delta II



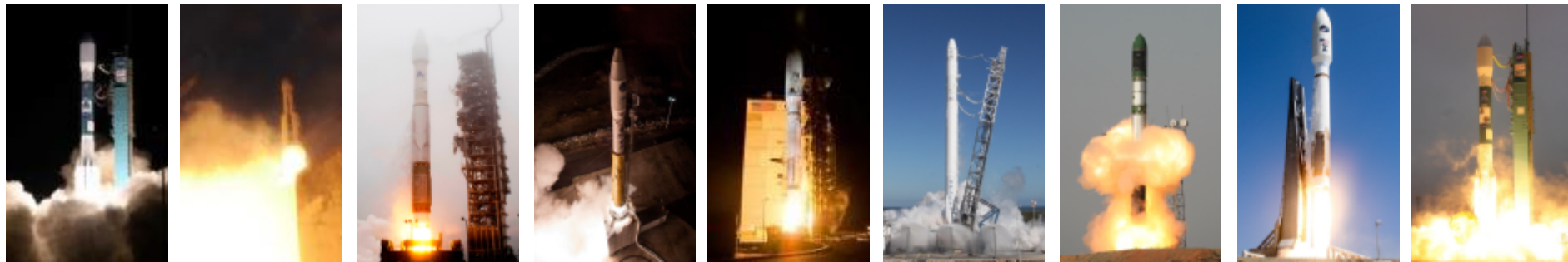
## • Space Ports

- Vandenberg Air Force Base, USA
- Cape Canaveral Air Force Station, USA
- NASA Wallops Flight Facility, USA
- Reagan Test Site, Kwajalein Atoll
- Kodiak Launch Complex, USA
- Guiana Space Centre, Kourou
- Baikonur Cosmodrome, Kazakhstan
- Yasny Launch Base, Russia
- Plesetsk Cosmodrome, Russia



# Launch Pace

- **Reliable point of access to space for secondary payloads**
  - US and International Missions
  - ULA, SpaceX, Orbital, Kosmotras, ect.
- **CubeSat integrator for most US Gov. Missions**
  - Air Force, NASA, ect.

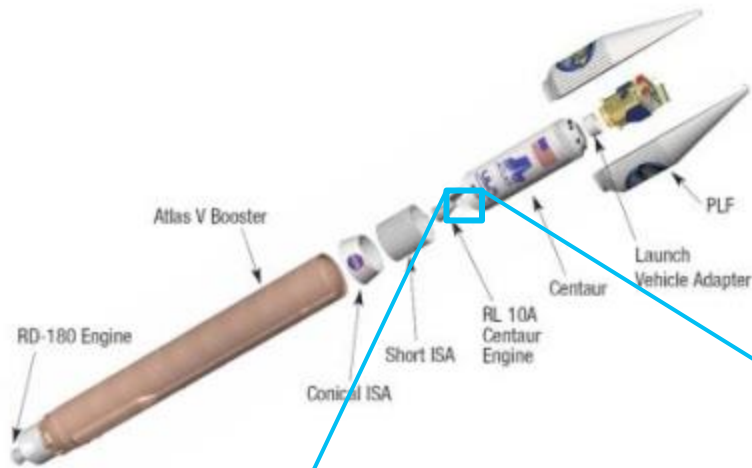


2012

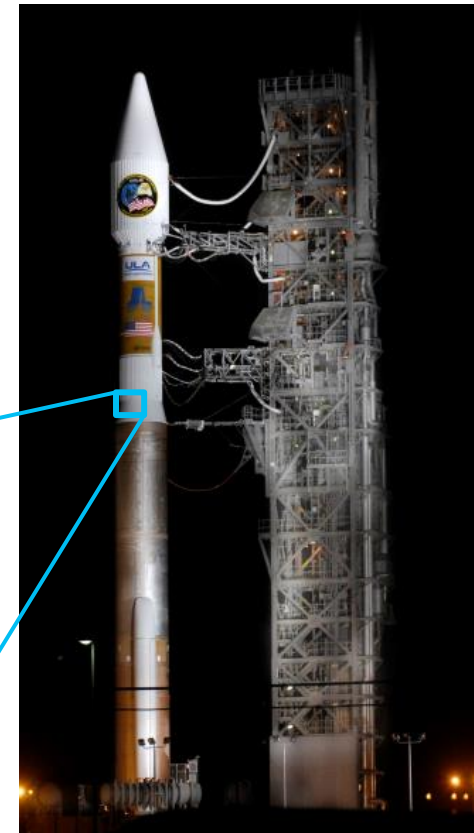
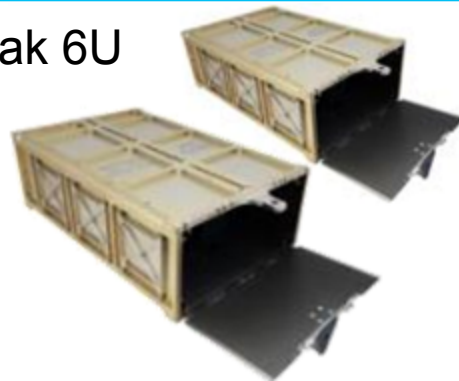
2015

# Taking the Next Step: Interplanetary Access for CubeSats

- Tyvak with working with NASA LSP, NASA JPL, and ULA to pioneer Interplanetary Access for CubeSats
- First ever interplanetary mission will be MarCO, a pair of 6U CubeSats developed by NASA JPL launching March 2016

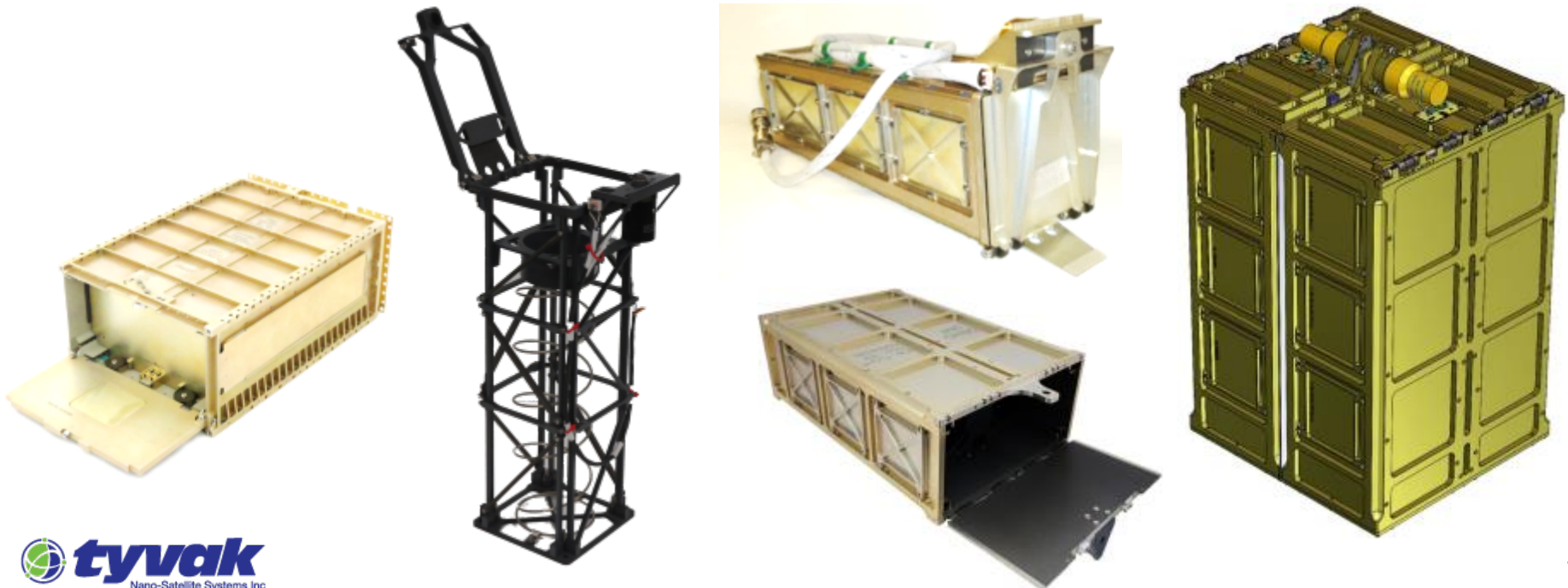


2x Tyvak 6U

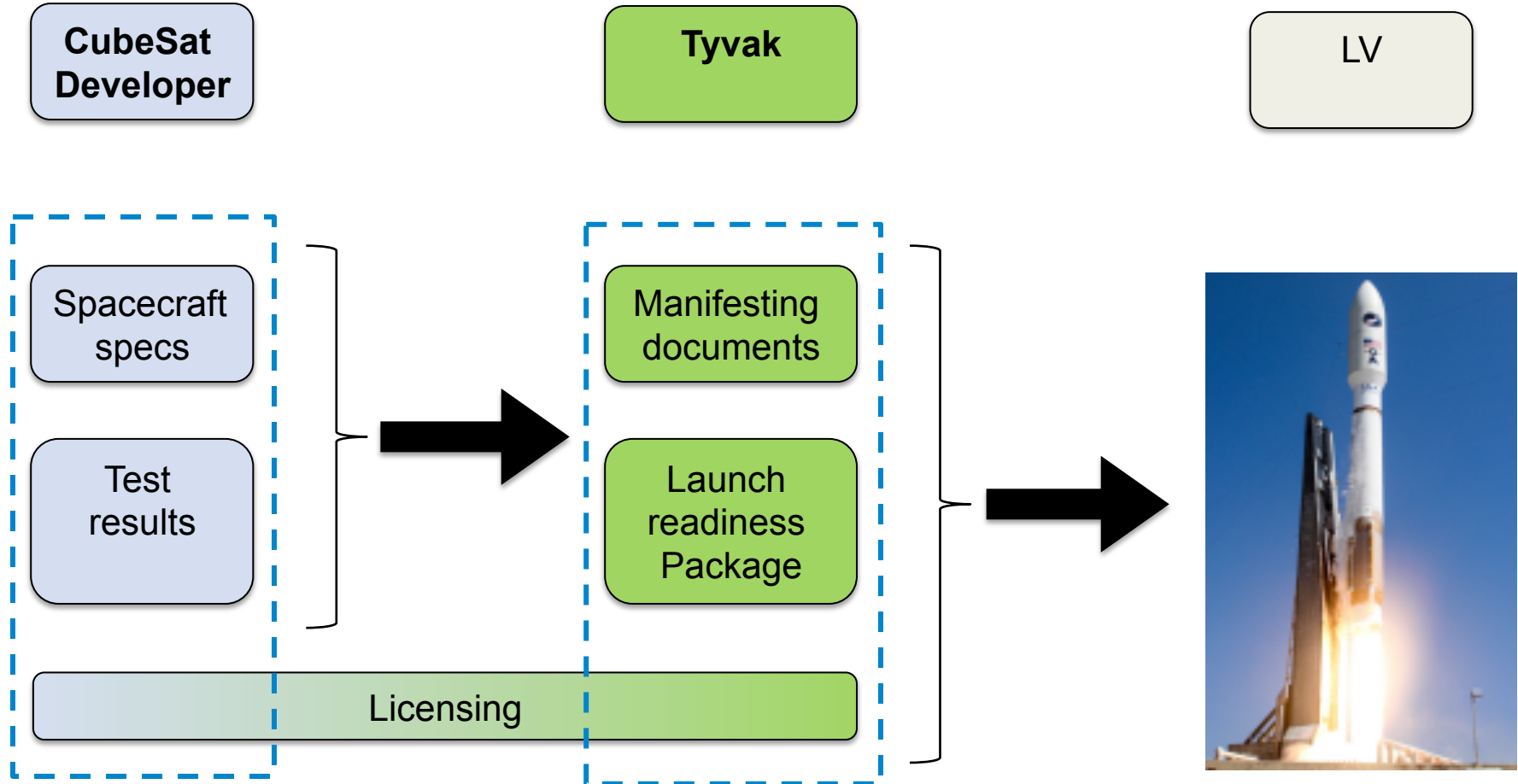


# Launch Interfaces

- Tyvak is currently working with launch providers developing standard interfaces to baseline secondary payload capability for more launches
- Focus on providing the most flexible interfaces, providing more opportunities for more payloads
  - Rails, Tabs, Propulsion, other advanced capabilities
- The wide range of CubeSat deployer systems that Tyvak can access enable launch capability across launch platforms
  - 1U, 3U, 12U, Interplanetary, Nano Launch Vehicle



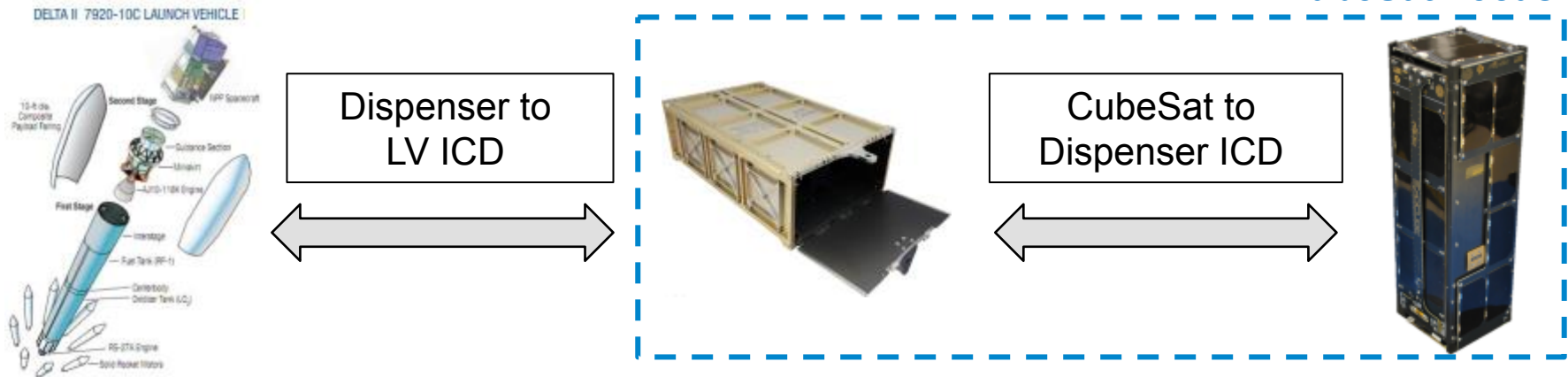
# Tyvak and CubeSat Work Flow



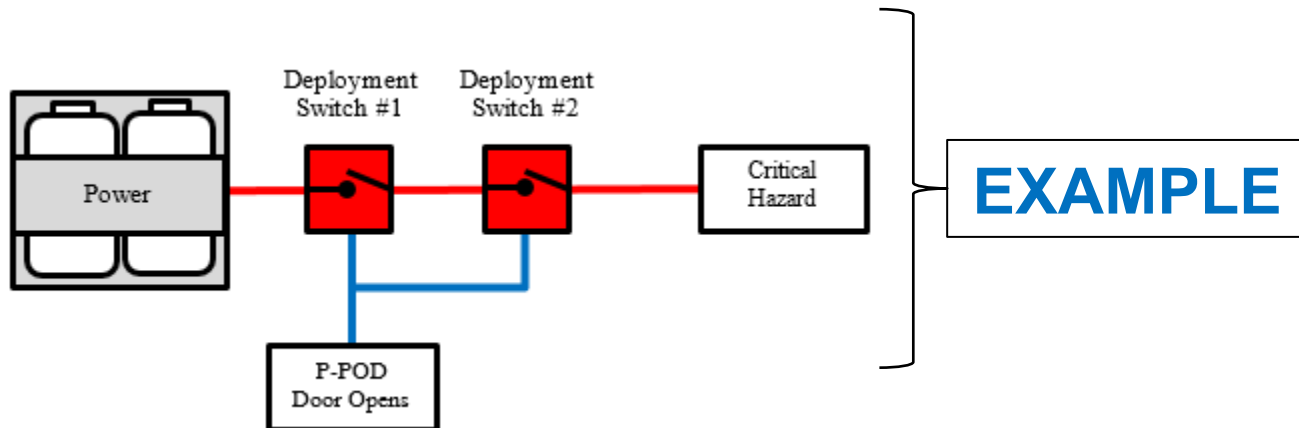


# CubeSat Focus

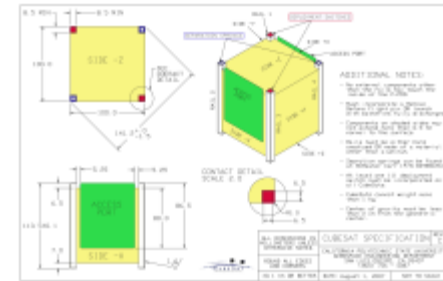
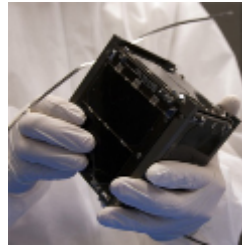
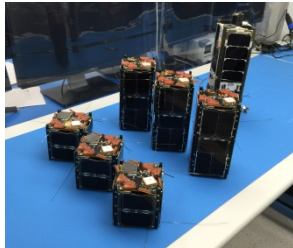
- The CubeSats will work to the CubeSat to Dispenser ICD



- Tyvak leverages a number of deliverable templates to simplify flight certification documentation
  - Safety, ICD Verification, Testing



# CubeSat Delivery and Integration Flow



CubeSats Delivered to Integration Facility In California

Post-Delivery Checkout (Functional Checkout, Battery Charging)

Physical measurements on CubeSats using CubeSat Acceptance Checklist (CAC)

CubeSat to P-POD Integration

Delivery to Launch Site & Integration to Launch Vehicle

Launch



# Launch Opportunities

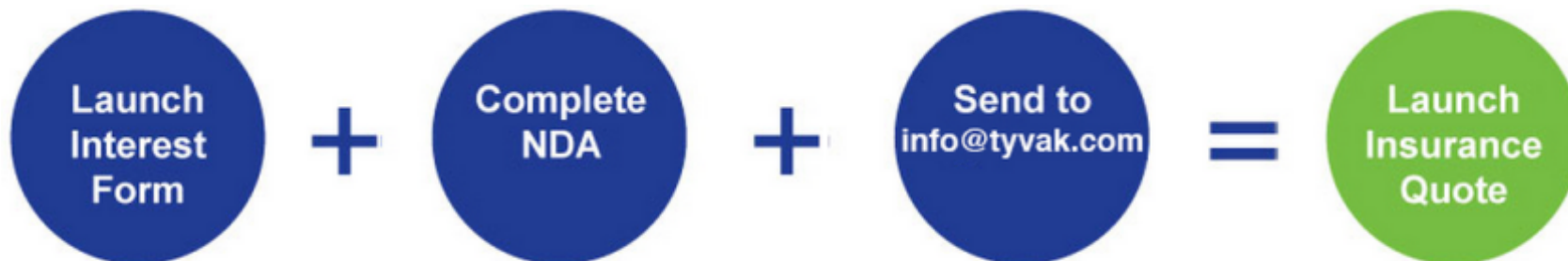
- **Over 215U of Launch Capacity**
- **Wide Range of Future Launch Opportunities to Fly Your Payload by 2017**

Date	Destination	Vehicle	Capacity
Q1 2016	LEO SSO	International	12 U
Q2 2016	LEO	Russian	12U
Q2/Q3 2016	LEO SSO	International	12 U
Q3 2016	LEO	Russian	24 U
Q4 2016	LEO	Russian	24 U
H2 2016	LEO SSO	International	12 U
2017	LEO/Lunar	US	24 U+
Q1 2017	LEO	Russian	24U
Q1 2017	LEO SSO	International	24U
Q2 2017	LEO SSO	Russian	24U+
Q4 2017	LEO SSO	Russian	24U+

# Launch and Satellite Insurance

- **We offer insurance services on major U.S. and International Launch Vehicles**
  - Competitive rates and favorable payment terms
  - Simple and efficient process and contract
- **Any satellite from the smallest CubeSat to a SmallSat in the 10's of kg can get insurance**
  - Comprehensive package for reducing financial risk and providing piece of mind
  - Can cover the full cost of the launch, typically the largest single expensive in a small satellite budget
  - Can cover the full cost of replacing the satellite, including COTS subsystems

<http://tyvak.com/launch-insurance/>



# Questions?

**More Information at:**

[Tyvak.com/tls/](https://tyvak.com/tls/)

[Tyvak.com/launch-insurance/](https://tyvak.com/launch-insurance/)

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