Introducing Space Phoenix Systems' *TR LEAP*

Technology Readiness Level Acceleration Program

Accelerating the Path from Space Technology Development to Orbital Deployment

The commercial space industry is entering a transformative decade. Governments, defense agencies, and private enterprises are investing billions of dollars into orbital infrastructure, autonomous systems, advanced computing, communications, materials science, and in-space manufacturing. Yet despite this unprecedented pace of innovation, one major bottleneck is crippling progress throughout the space economy:

The inability to rapidly validate emerging technologies in real operational environments.

Technology Readiness Level (**TRL**) is a standardized framework originally developed by NASA to measure the maturity of a technology, from early-stage research (TRL 1) through operational deployment (TRL 9). Each level represents progressively greater validation through analysis, laboratory testing, environmental qualification, and demonstrated reliable performance.

For orbital deployment, achieving TRL 9 is a mandatory requirement. Spacecraft systems and components must demonstrate reliable operation under extreme and inaccessible conditions, including radiation exposure, vacuum environments, thermal cycling, launch vibration, and microgravity. Rigorous qualification and certification are essential to reducing mission risk and ensuring operational reliability. Technologies which achieve TRL - 9 validation enable mission operators, investors, insurers, regulators, and acquisition authorities to make informed deployment decisions with greater confidence.

For many companies, however, the challenge is not developing innovative technologies or even achieving *flight-qualified and market-ready TRL- 9 designations*. It's that promising technologies stall between prototype validation (TRL 4–7) and operational deployment because organizations lack affordable, repeatable opportunities to demonstrate performance in space. This growing gap between innovation and deployment has become one of the most significant constraints in the modern space economy.

Achieving Technology Readiness Level (TRL 7) marks the critical transition from prototype testing in a relevant environment to demonstrating a high-fidelity system prototype in an actual operational environment. At this stage, the focus is on validating the integration, functionality, and performance of the near-final system under real-world operating conditions. Testing subsystems in an operational environment significantly reduces the risks associated with progressing to TRL 9 - the highest level of technology maturity - where the system is considered "flight proven" or "mission proven" through successful operational deployment.

Today, TRL 7 testing is typically conducted on satellites that do not have return capability, meaning that tested hardware remains in orbit after the mission. For high-value subsystems such as radars, sensors, propulsion systems, and high-power amplifiers, leaving these expensive assets in space following testing and evaluation, is a very costly practice which is unstainable, particularly with the increasing concern about the damage caused by orbital debris.

The TRL Bottleneck in the New Space Economy

The emerging multi-trillion-dollar space market is the catalyst for massive change across the aerospace sector, with organizations racing to develop and validate the technologies needed to enable orbital data centers, autonomous spacecraft, advanced sensing systems, robotics, thermal management, AI-enabled edge computing, resilient communications networks and more.

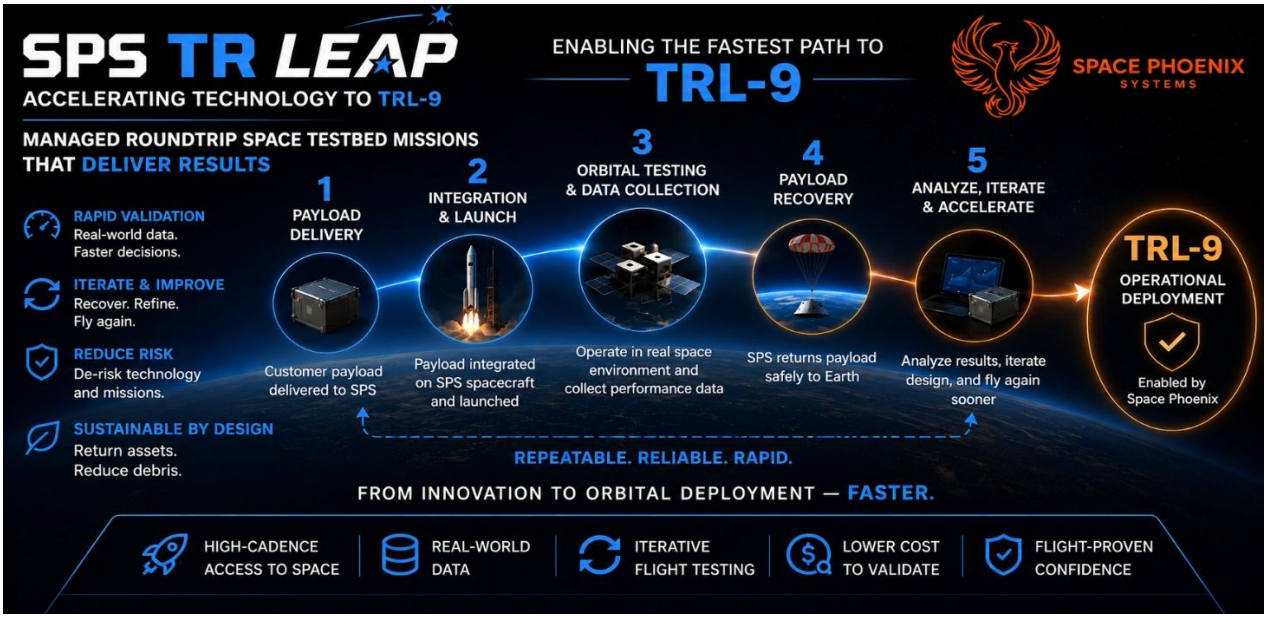
But, despite the best efforts of numerous entities, advancing their technologies from TRL 4 or 5 to TRL 7. and ultimately to TRL 9. are severely hampered by a TRL bottleneck caused by limited, infrequent, and prohibitively expensive access to space missions. This has created a growing backlog of innovative capabilities that remain undeployed because organizations lack practical pathways to validate their technologies in operational conditions.

The industry now faces a clear paradox:

- Innovation is accelerating
- Capital investment is increasing
- Demand for orbital infrastructure is growing
- Yet deployment velocity remains constrained by limited testing access

Space Phoenix Systems is eliminating the TRL Bottleneck.

Introducing TR LEAP- *A Returnable Spacecraft Platform for Rapid TRL Advancement*



Space Phoenix Systems has developed a fundamentally different model for space qualification and technology maturation. Rather than relying solely on one-time rideshare launches or expensive dedicated missions, TR LEAP offers a returnable spacecraft platform specifically designed to accelerate technology readiness through repeatable flight opportunities and post-mission payload recovery and return.

This capability enables organizations to:

- Rapidly validate subsystem performance in true space environments
- Collect real operational flight data
- Accelerate hardware iteration cycles
- Reduce deployment and mission risk
- Demonstrate flight-proven performance to stakeholders
- Shorten the timeline from laboratory innovation to orbital commercialization
- Return high-value assets to Earth, rather than leave them in orbit as debris

SPS TR LEAP missions provide organizations with high-cadence access to real-world orbital conditions without the enormous capital expenditures and long wait times traditionally associated with space qualification programs. By integrating payload pick-up, spacecraft payload integration, launch access, operational monitoring and testing, payload recovery, and iterative mission cycles into a single platform, SPS provides a practical and cost-effective pathway for technologies to progress through critical TRL milestones with significantly greater speed and efficiency

For developers of emerging orbital technologies, SPS offers a uniquely valuable capability: the ability to economically test, recover, analyze, improve, and rapidly fly again. This iterative development loop is the key to accelerating TRL advancement and reducing the time required to bring next-generation space technologies to market.

TR LEAP enables…

- Faster testing and qualification cycles
- Lower barriers to orbital validation
- More frequent flight opportunities
- Continuous hardware evolution and refinement
- Reduced deployment and operational risk
- Significant cost reduction
- The ability to return and re-purpose high-value assets to Earth

In summary, Space Phoenix Systems' Technology Readiness Level Acceleration Program is helping bridge the critical gap between innovation and deployment — economically accelerating the commercialization of next-generation space systems and enabling faster advancement across the global space economy.

Space Phoenix Systems is now accepting reservations for its TR LEAP missions scheduled in 2028 through 2030.

If you're interested in learning more or see if you qualify, please contact Space Phoenix Systems at connect@space-phoenix.com