What key milestones move a deep-tech startup from TRL4 to TRL6

The key milestones that move a deep-tech startup from TRL4 (technology validated in lab) to TRL6 (system/subsystem model or prototype demonstrated in a relevant environment) focus on prototype development, validation, and demonstrating technology viability outside the controlled lab setting.[1] [2] [3]

Major Milestones from TRL4 to TRL6

- **TRL4 (Technology validated in laboratory)**
  - Integration and testing of key components to ensure they work together under lab conditions, confirming technical feasibility.[3] [1]
  - Preparation of initial intellectual property (IPR) documentation and outlining protection strategies needed for commercialization.[1]
  - Defining the target use case and outlining key performance indicators for application-relevant environments.[1]
- **TRL5 (Technology validated in relevant environment)**
  - Building an advanced prototype or pilot system suitable for testing in a simulated or real-world setting that closely mimics intended use conditions.[2] [3]
  - Execution of comprehensive tests in these relevant settings, addressing issues such as reliability, durability, and operational integration.[2]
  - Advancing intellectual property protection (e.g., patents), seeking customer feedback, and refining regulatory or certification roadmaps.[1]
  - Preparing targeted technical data to meet investor and grant agency requirements, aligning with potential industry partnership needs.[1]
- **TRL6 (Technology demonstrated in relevant environment)**
  - Demonstration of a fully functional prototype or pilot system operating in a relevant, application-specific environment (not just the laboratory).[3] [1]
  - Collecting robust performance data and validation feedback from real users or pilots in the target sector.[2]
  - Initiating industry collaborations or acquiring early adopter agreements to confirm market interest and build commercialization readiness.[1]
  - Ensuring intellectual property is secured and investor/funding material is up-to-date to attract further growth capital.[1]

Additional Considerations

- Team strengthening in business, technical, and commercial areas is crucial alongside technical milestones.[1]
- Planning for regulatory, safety, and industrial scale-up requirements should begin in parallel as the technology transitions beyond the lab.[1]

Progressing from TRL4 to TRL6 is known as “crossing the valley of death” – a critical stage requiring not only technical validation but also commercial, IP, and investor alignment for long-term success.[2] [1]

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