

Appendix B: Technology Readiness Level (TRL) Descriptions

Technology Readiness Level - (TRL)	Definition	Hardware Description	Software Description	Exit Criteria
1	Basic principles observed and reported	Scientific knowledge generated underpinning hardware technology concepts/applications.	Scientific knowledge generated underpinning basic properties of software architecture and mathematical formulation.	Peer reviewed publication of research underlying the proposed concept/application
2	Technology concept or application formulated	Invention begins, practical application is identified but is speculative, no experimental proof or detailed analysis is available to support the conjecture.	Invention begins, practical application is identified but is speculative, no experimental proof or detailed analysis is available to support the conjecture. Underlying Algorithms are clarified and documented.	Documented description of the application/concept that addresses feasibility and benefit
3	Analytical and/or experimental critical function or characteristic proof-of-concept	Analytical studies place the technology in an appropriate context and laboratory demonstrations, modeling and simulation validate analytical prediction.	Development of limited functionality to validate critical properties and predictions using non-integrated software components	Documented analytical/experimental results validating predictions of key parameters
4	Component or breadboard validation in laboratory	A low fidelity system/component breadboard is built and operated to demonstrate basic functionality and critical test environments and associated performance predictions are defined relative to the final operating environment.	Key, functionally critical, software components are integrated, and functionally validated, to establish interoperability and begin architecture development. Relevant Environments defined and performance in this environment predicted.	Documented test performance demonstrating agreement with analytical predictions. Documented definition of relevant environment.
5	Component or breadboard validation in a relevant environment	A mid-level fidelity system/component brassboard is built and operated to demonstrate overall performance in a simulated operational environment with realistic support elements that demonstrates overall performance in critical areas. Performance predictions are made for subsequent development phases.	End to End Software elements implemented and interfaced with existing systems conforming to target environment, including the target o software environment. End to End Software System, Tested in Relevant Environment, Meets Predicted Performance. Operational Environment Performance Predicted.	Documented test performance demonstrating agreement with analytical predictions. Documented definition of scaling requirements
6	System/subsystem model or prototype demonstration in a relevant environment	A high-fidelity system/component prototype that adequately addresses all critical scaling issues is built and operated in a relevant environment to demonstrate operations under critical environmental conditions.	Prototype software partially integrated with existing hardware/software sytems and demonstrated on full-scale realistic problems.	Documented test performance demonstrating agreement with analytical predictions
7	System prototype demonstration in space	A high fidelity engineering unit that adequately addresses all critical scaling issues is built and operated in a relevant environment to demonstrate performance in the actual operational environment and platform (ground, airborne or space).	Prototype software is fully integrated with operational harware/software sytems demonstrating operational feasibility.	Documented test performance demonstrating agreement with analytical predictions
8	Actual system completed and flight qualified through test and demonstration	The final product in its final configuration is successfully demonstrated through test and analysis for its intended operational environment and platform (ground, airborne or space).	The final product in its final configuration is successfully [demonstrated] through test and analysis for its intended operational environment and platform (ground, airborne or space).	Documented test performance verifying analytical predictions
9	Actual system flight proven through successful mission operations	The final product is successfully operated in an actual mission.	The final product is successfully operated in an actual mission.	Documented mission operational results