TECHNOLOGY READINESS LEVELS (TRL 1 TO 9)

Official definitions, quoted word for word

TRL	NASA (NPR 7123.1, Appendix E)	European Union (Horizon Europe)	NTRAF, India (definition and stage)	In plain words (Zernyx's explanation)
1	Basic principles observed and reported.	Basic principles observed	Basic principles observed and reported *Basic Technology Research*	A scientific effect is seen and written up. No application yet.
2	Technology concept and/or application formulated.	Technology concept formulated	Technology concept formulated *Research to Prove Feasibility*	Someone proposes how the effect could be used. Mostly paper and analysis.
3	Analytical and experimental proof-of-concept of critical function and/or characteristics.	Experimental proof of concept	Experimental proof of concept *Research to Prove Feasibility*	The key function works in a lab experiment, usually on separate parts.
4	Component and/or breadboard validation in a laboratory environment.	Technology validated in a lab	Component and/or system validation in lab *Technology Demonstration*	The parts are put together and work as a rough system on the bench.
5	Component and/or brassboard validated in a relevant environment.	Technology validated in a relevant environment (industrially relevant environment in the case of key enabling technologies)	Laboratory scale, similar system validation in relevant environment *Technology Demonstration*	A higher-fidelity version is tested in conditions that simulate real use.
6	System/sub-system model or prototype demonstration in a relevant environment.	Technology demonstrated in a relevant environment (industrially relevant environment in the case of key enabling technologies)	Engineering/pilot-scale prototype demonstrated in relevant environment *Technology Demonstration*	A representative prototype performs all its key functions in near-real conditions.
7	System prototype demonstration in an operational environment.	System prototype demonstration in an operational environment	Full scale system prototype demonstration in operational environment *System Commissioning*	A near-final prototype works in the actual setting: a plant, a hospital, a field.
8	Actual system completed and "flight qualified" through test and demonstration.	System complete and qualified	System complete and qualified through test and demonstration *System Commissioning*	The final product passes its tests and, where needed, its certifications.
9	Actual system flight proven through successful mission operations.	Actual system proven in an operational environment (competitive manufacturing in the case of key enabling technologies, or in space)	Actual system proven in operational environment over full range of expected conditions *System Operations*	The product runs in real use across the full range of expected conditions.

These scales are general: the same wording applies to every kind of technology. For a domain-specific assessment, TRL Pro uses ZTRAF, Zernyx's own framework, organised across more than 60 technology domains and subdomains.

Sources: NPR 7123.1D, NASA Systems Engineering Processes and Requirements, Appendix E. Technology Readiness Levels; Horizon Europe Work Programme 2026-2027, 15. General Annexes, "Technology Readiness Levels"; National Technology Readiness Assessment Framework, Section 2, Core Definitions (Office of the Principal Scientific Adviser to the Government of India). Checked 2026-11-21.

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