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Electromagnetic Railgun

What Is It?

The Electromagnetic (EM) Railgun is a long-range weapon that fires projectiles using electricity instead of chemical propellants. Magnetic fields created by high electrical currents accelerate a sliding metal conductor, or armature, between two rails to launch projectiles at 4,500 mph to 5,600 mph.

How Does It Work?

Electricity generated by the ship is stored over several seconds in the pulsed power system. Next, an electric pulse is sent to the railgun, creating an electromagnetic force accelerating the projectile at speeds of up to Mach 7. The kinetic energy warhead eliminates the hazards of high explosives in the ship and unexploded ordnance on the battlefield.

What Will It Accomplish?

With its increased velocity and extended range, the EM Railgun will give Sailors a multimission capability, allowing them to conduct precise naval surface fire support, or land strikes; cruise missile and ballistic missile defense; and surface warfare to deter enemy vessels. Navy planners are targeting a 50- to 100-nautical mile initial capability. A variety of new and existing naval platforms—including the DDG51—are being studied for integration of a future tactical railgun system.

The Department of the Navy's science and technology corporate board chartered the [Innovative Naval Prototype](#) (INP) construct to foster game-changing and disruptive technologies ahead of the normal requirements process.

The Electromagnetic Railgun INP was initiated in 2005. The Phase I goal of 32 megajoule muzzle energy proof-of-concept demonstration has been achieved. A future weapon system at this energy level would be capable of launching a 100-nautical mile projectile. This launch energy has the advantage of being able to stress many components to evaluate full-scale mechanical and electromagnetic forces.

Phase I was focused on the development of launcher technology with adequate service life, development of reliable pulsed power technology and component risk reduction for the projectile.

Phase II, which started in 2012, will advance the technology for transition to an acquisition program. Phase II technology efforts will concentrate on demonstrating a 100-rounds-per-minute firing rate. Thermal management techniques required for sustained firing rates will be developed for both the launcher system and the pulsed power system.

The railgun is a true warfighter game-changer. Wide-area coverage, exceptionally quick response and very deep magazines will extend the reach and lethality of ships armed with this technology.

More information:

Details: [Electromagnetic Railgun Program](#)

Video: [Watch video on ONR's official YouTube page](#)

[Download \(PDF 917.32 KB\)](#)

Research Opportunities:

- Advanced thermal management techniques for long (10-meter), slender metal rail structures
- Extended service life for materials and components in harsh environment
- High-strength, dielectric, structural materials
- High-speed, high-current metal-on-metal sliding electrical contact
- System interfaces between high-power loads and platform power distribution
- Compact pulsed power systems and power electronics
- High-conductivity, high-strength, low-density conductors
- Repetitive rate switches and control technologies
- Aerothermal protection systems for flight vehicles
- High-acceleration tolerant electronic components and structural materials

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