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Navy researchers fire 1,000th shot on laboratory electromagnetic railgun

October 31, 2011

Enlarge

Without the need for dangerous explosives storage and handling, the Electromagnetic Railgun can potentially reach targets up to 20 times farther than conventional weapons. Credit: Naval Research Laboratory

Scientists at the Naval Research Laboratory (NRL) hit a materials research milestone in the Office of Naval Research's (ONR) Electromagnetic Railgun program when they fired a laboratory-scale system for the 1,000th time Oct. 31.

"A significant amount of development has been coming out of NRL to support the program," said Roger Ellis, ONR's Electromagnetic Railgun (EMRG) program officer. "It's a key piece of making railgun successful."

The EMRG is a long-range weapon that launches projectiles using electricity instead of chemical propellants. Under development by the Department of the Navy (DON) for use aboard ships, the system will provide Sailors with multi-mission 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.

"The weapon does all its damage because of its speed," said Dr. Roger McGinnis, program executive for ONR's Naval Air Warfare and Weapons Department, which oversees EMRG. Launched at 2 to 2.5 kilometers per second (4,500 to 5,600 mph) without using explosives, the projectile reaches its target at speeds that require only a small charge similar to that found in automobile airbags to dispense its payload, eliminating the objective through the inherent kinetic energy.

"EMRG will provide the Department of Defense with an advantage in future conflicts by giving troops the ability to fire weapons inexpensively against targets," McGinnis said.

As part of the EMRG development program, ONR and NRL co-funded scientists at NRL to build and operate a 6-meter long, 50 mm diameter railgun as a subscale experimental lab at the Materials Testing Facility (MTF). Researchers fired the first shot in March 2007. After improving the gun's sliding armature and rails, the lab has fired an average of 300 shots per year since 2008.

A railgun launches projectiles by generating magnetic fields created by high electrical currents that accelerate a sliding metal conductor, or armature, between two rails.

"The 1,000th shot is testing new ideas of how the armature interacts with the rails," said Dr. Robert Meger, head of NRL's charged particle physics branch, which conducts about 30 experiments annually on the railgun. Following each test firing, researchers dismantle the gun to examine all the components. They slice up the rails for further analysis under a microscope to reveal surface damage.

During the course of firing all 1,000 shots, NRL scientists have experimented with a variety of materials and geometries to determine which ones can withstand the metal-melting temperatures and pressures of shooting a 1.5-megajoule energy weapon. One megajoule of energy is equivalent to a 1-ton car traveling at 100 miles per hour.

"We've really explored a lot of territory," ONR's Ellis said. "When you couple what we're seeing in testing with what we're seeing in modeling and simulation, it results in some interesting barrel shapes that you wouldn't intuitively think about. Railgun barrels don't necessarily have to be round as in most conventional gun designs."

Since 2005, scientists have been working to increase the railgun's barrel life, muzzle energy and size. Ultimately, their work will help to produce a 64-megajoule railgun with a range of about 220 nautical miles.

"You really have to look at the course of our understanding from the first day they shot to the 1,000th shot today, and how much our understanding of the rail life has dramatically increased, and how much science we have applied to ensure that we're on the path toward a future fieldable system," Ellis said.

Materials science breakthroughs resulting from the test firings have given researchers confidence to transition new technologies to a scaled-up experimental launcher at Naval Surface Warfare Center Dahlgren,Va., which fired a world record setting 33-megajoule shot in December 2010.

Provided by Office of Naval Research

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Nerdyguy
Oct 31, 2011

Rank: **3 / 5 (5)**
I read, on average, about one article a year about railguns. Been doing this since Ronald Reagan was in office. That's a pretty long development time for a technology that, on the surface, doesn't seem all that technologically advanced. Obviously, that's only on the surface, as it's presented new challenges every time they try to scale it up.

But, I would like to eventually see something come out of this beyond "for future conflicts". And, I'd guess, so would the policymakers/purse-string holders.

- report

hemitite
Oct 31, 2011

Rank: **2.3 / 5 (3)**
It sounds to me like they have some real problems with the moving parts melting or quickly wearing out. And then there's dirt and rain and salt spray outside the lab to consider: I sure wouldn't want to be anywhere near a miss firing 64-megajoule railgun!

It seems of the face of it that the natural home for this sort of beast would be in outer space - it could even be used as a drive assuming that you weren't pulling away from anything fragile.

- report

Skepticus
Oct 31, 2011

Rank: **2.7 / 5 (3)**

> ...Following each test firing, researchers dismantle the gun to examine all the components. They slice up the rails for further analysis under a microscope to reveal surface damage....During the course of firing all 1,000 shots, NRL scientists have experimented with a variety of materials and geometries

This is misleading news. The railgun did NOT fired 1000 shots with the same setup from beginning to end. They have learned a lot and increased the kinetic energy of the projectile, but no fundamental break though in lifetime of the components was discovered.

- report

Birger
Nov 01, 2011

Rank: **1 / 5 (2)**
What kind of capacitors are they using for the railgun? The bulkiness of those seems to me a possible deal-breaker.

"a 64-megajoule railgun with a range of about 220 nautical miles."
There must be a flaw with the decimal points. Assuming a velocity of 2500 m/s, this means a missile mass of 20 kg. Such a small missile will rapidly lose energy through friction even before it reaces the relatively thin upper atmosphere.
220 nautical miles is about 400 km. To reach this range the missile must have a velocity (after drag losses) of about 2000m/s assuming a launch at 45 degrees to the vertical.
The small assumed friction makes me highly suspicious...

- report

NotAsleep
Nov 01, 2011

Rank: **4.8 / 5 (5)**
Birger, the original intent of this particular weapon was to fire a projectile so fast that it could follow the curvature of the earth and hit a target over 20km away with a "straight shot". As you stated, speed is a critical factor in that and as the article says, yes, over 2,000m/s (2-2.5 km/s from the article) is what they're hoping for.

As for the capacitors, keep in mind that they're mounting these on US Naval ships that are more than capable of carrying the necessary weight, especially if there's a corresponding decrease in "traditional" ammo and hardened ammo container weight. In war, all of life is a trade off

- report

Blaspheyou
Nov 01, 2011

Rank: **2 / 5 (3)**
First off, considering how much money has been spent on r&d, this isn't cheaper than traditional naval guns. Secondly, when was the last time the navy fired guns in support of ground troops? This is rather like America's VTOL fighter jets: a cool idea that will never be used.

- report

Nerdyguy
Nov 01, 2011

Rank: **5 / 5 (2)**

> First off, considering how much money has been spent on r&d, this isn't cheaper than traditional naval guns. Secondly, when was the last time the navy fired guns in support of

> ground troops? This is rather like America's VTOL fighter jets: a cool idea that will never be used.

The naval/marine version of the F35 won't be used?

- report

antialias_physorg
Nov 01, 2011

Rank: **3 / 5 (4)**

> I read, on average, about one article a year about railguns. Been doing this since Ronald Reagan was in office. That's a pretty long development time for a technology that, on the surface, doesn't seem all that technologically advanced.

Add to that that ther hasn't been a naval engagement for 60 years (and if there ever is one then it would involve aircraft/drones/missiles with larger range than a railgun could muster.)

- report

Pyle
Nov 01, 2011

Rank: **4.8 / 5 (6)**
Hopefully the things we are learning will be applied towards non violent ends. Launching payloads into orbit or onto the moon? Deflecting asteroids? etc.

Regarding alternative, longer range weaponry. Once the tech is built, firing the rail gun is relatively inexpensive compared to the other techs. The cost is in the development.

- report

Nerdyguy
Nov 01, 2011

Rank: **5 / 5 (2)**
"firing the rail gun is relatively inexpensive compared to the other techs. The cost is in the development. " - Pyle

Yes, and I think it's the only real reason that this technology continues to be explored. If it can be made to work, it's undeniable that it could have a variety of uses and be extremely efficient. Just imagine this coupled with a source of relatively cheap "renewable" energy, like the small nuclear plants on submarines, and it could fire repeatedly for a VERY long time at little cost compared to building and "one-shotting" explosive ordinance.

- report

NotAsleep
Nov 01, 2011

Rank: **4 / 5 (3)**
I love finding these articles about war and reading the comments. It's as if some people have lived with their eyes closed their entire lives

Antialias, The Navy performs constantly in the middle east while also combating pirates off the coast of Somalia. There are lots of other examples of naval warfare (see: North/South Korea) but I'll leave it to you to look them up if you really care.

Blaspheyou, R&D is a key element of acquisitions. It determines the cost of the rest of the system's lifecycle. If we built a poor rail gun that broke all the time, it wouldn't make much sense. The first artillery that was developed blew up all the time, killing all the men around it. Perhaps they didn't spend enough in R&D...

America has no VTOL fighter jets. The F-35 is a STOVL, "short take off, vertical landing" and will likely replace F/A-18 Hornets on Navy carriers. The Harrier jet is English-made, although the marines use it... and it's a nightmare to use

- report

antialias_physorg
Nov 01, 2011

Rank: **3 / 5 (4)**

> Antialias, The Navy performs constantly in the middle east while also combating pirates off the coast of Somalia. There are lots of other examples of naval warfare (see: North/South Korea) but I'll leave it to you to look them up if you really care.

And you might notice they aren't using the big guns in any of those scenarios (not because they are such a threat. Every frigate has ammunitions that dwarf the capabilities of big guns. That's why none of them field any anymore). Helicopters, the occasional machine gun salvo. That's about it.

- report

Nerdyguy
Nov 01, 2011

Rank: **3 / 5 (4)**
@NotAsleep:

"no naval engagement for 60 years" is accurate as most people understand a naval engagement. You are technically correct, but playing semantics, if you include taking on pirates off Africa.

Same thing with VTOL. The commenter said it was a cool idea that will "never" be used. You mentioned the F-35 as SVTOL. Again, you are technically correct but playing semantics. The technology used to provide a vertical take off and landing is in existence and fully functioning within the F-35. It works just fine, which is counter to the original commenter's claim. The fact that its range

and capabilities are affected by fuel and ordinance weight are not critical in establishing that VTOL is present and workable.

- report

NotAsleep
Nov 01, 2011

Rank: **5 / 5 (2)**
NerdyGuy, my apologies, I wasn't trying to imply that the F-35 was anything less than fantastic. I look forward to the day it gets some combat hours.

As for naval engagements, I also think that most people's understanding of a naval engagement is a little outdated. Guided missiles and air power have rendered big guns obsolete since Desert Storm when the last big guns were fired but that doesn't mean there have been no naval engagements

Antialias, big guns, no. Big missiles, yes. In fact, there are no more US Navy ships with big guns (to my knowledge). Nevertheless, an "inexpensive" rail gun that can fire guided munitions several hundred kilometers could quickly change things yet again

- report

Skepticus
Nov 03, 2011

Rank: **1 / 5 (1)**
I really love the big baboons' unerringly single-minded pursuit of pouring trillions of dollars into "better and faster" means of killing over who should influence,own, say or do what! Let's bring on a few more world wars! The multinational weapons manufacturers will be in rapture with the increased and steady business profits. It will reduces unemployment, young dumb-heads and parasites that has nothing to contribute except to die as cannon fodder. It will certainly drown all the attention on the economy, the wealth inequality between the super-rich and the rabbles. The under-funded sick, frail and old, malnourished babies and children around the globe can all be f*cked off with excuses of war conditions, thus reducing global over-population. The world will see a resurgent of splendid technological advancements for the next round of wars! Let's start with Iranians as some Israelis officials has been pushing lately. I can't wait for the fire works and 1/3 population reduction!

- report

NotAsleep
Nov 03, 2011

Rank: **5 / 5 (1)**
Skepticus, what do you propose as an alternative? I'm all ears and will gladly and openly support a person that can get humanity away from war.

I look foward to a "Star Trek" world where energy is plentiful and replicators can make you anything you want. Removing physical need from the world and making everyone essentially equal from birth would leave only the last tier of the hierarchy of needs to pursue: self actualization

- report

Nerdyguy
Nov 03, 2011

Rank: **5 / 5 (2)**
@Skepticus:

Your concern for the poor and undernourished is admirable and to be commended.

However, in lieu of just hoping along with those "dumb-heads" you mention, perhaps it might be just slightly prudent for the U.S. military to actually plan and develop new technologies in its mission to protect U.S. interests.

In the real world -- vs. the Utopia you'd like to see -- we have real, concrete enemies and do need to protect ourselves.

As a side benefit, many new and fantastically useful technologies arise from this kind of basic research. These directly affect the U.S. economy (often the world) and help provide jobs for those poor and downtrodden you are concerned about. It seems to me a win-win situation.

- report

Skepticus
Nov 03, 2011

Rank: **2 / 5 (2)**
@NotAsleep: Sadly, no. History has shown that a well-entrenched system of governance such as Rome eventually crumbled from within. I may venture that as the rules of law, regulations, political and econmics issues be come more and more complex and numerous, a point will be reached where paralysis sets in. Agencies and parties will fight for different agendas and directions. Nationally, the disaffected will have two choices: Bent under the net of established propaganda machines and laws, well trained and equipped law enforcers and wait until the establishment go stupid and choke itself to death, or revolution, peaceful or otherwise. Lots of people will die gradually or quickly, take your pick. Internationally, political and economics reasons and decisions will force a hegemony to grow to survive and control the dissenters and the subjugated. Eventually, the growth will become unsustainable. Unless people can be programmed and control like robots, there is always someone who will fight.

- report

Skepticus
Nov 03, 2011

Rank: **2 / 5 (2)**
@Nerdyguy: Ofcourse it is prudence to protect one's national interests, by technical means or otherwise. But I have to ask you: HOW MUCH SELF-INTEREST IS ENOUGH? What is the threshold, so that you won't alienate yourself so much that everybody sees you as The Enemy, and you have to be constantly improve your protection? Of course you can't please everyone and be friends with them, but it doesn't mean you have to always try to lord over the rest, "for the advancement of civilization, democracy, freedom, and their own good blah blah blah et cetera et cetera". All the colonial and conquering powers since time immemorial learned it the hard way.

- report

NotAsleep
Nov 03, 2011

Rank: **5 / 5 (1)**
Skepticus, I recently reread Orwell's 1984 and found myself shocked at how relevant the themes still are. You just put me back into the state of depression I was in when I finished reading the book.

- report

kaasinees
Nov 03, 2011

Rank: **not rated yet**

> Antialias, The Navy performs constantly in the middle east while also combating pirates off the coast of Somalia. There are lots of other examples of naval warfare (see: North/South Korea) but I'll leave it to you to look them up if you really care.

> And you might notice they aren't using the big guns in any of those scenarios (not because they are such a threat. Every frigate has ammunitions that dwarf the capabilities of big guns. That's why none of them field any anymore). Helicopters, the occasional machine gun salvo. That's about it.

http://www.youtub...PCfjwPv4

The dutch do a lot of pirate catching.

- report

Nerdyguy
Nov 03, 2011

Rank: **5 / 5 (1)**

> @Nerdyguy: Ofcourse it is prudence to protect one's national interests, by technical means or otherwise. But I have to ask you: HOW MUCH SELF-INTEREST IS ENOUGH? What is the threshold, so that you won't alienate yourself so much that everybody sees you as The Enemy, and you have to be constantly improve your protection? Of course you can't please everyone and be friends with them, but it doesn't mean you have to always try to lord over the rest, "for the advancement of civilization, democracy, freedom, and their own good blah blah blah et cetera et cetera". All the colonial and conquering powers since time immemorial learned it the hard way.

Nothing here that I would disagree with. A nation's goals and interests must be balanced within the framework of the international community and its needs.

- report

Nerdyguy
Nov 03, 2011

Rank: **5 / 5 (1)**
"History has shown that a well-entrenched system of governance such as Rome eventually crumbled from within...unless people can be programmed and control like robots, there is always someone who will fight." - skepticus

Makes me think we should refocus on making that railgun, as we made need it! Sarcasm, of course.

I don't think that things are necessarily bound to follow the precise pattern of all the world's worse historical events. In fact, many nations which formerly "lorded" it (your words) over the rest of the world continue today to have a high standard of living, a decent economy, strong schools, a well-educated populace, etc. Examples would be: Italy, Spain, England, Japan, Germany, etc. In reality, those Romans aren't exactly doing too badly for themselves.

- report

Skepticus
Nov 03, 2011

Rank: **2.5 / 5 (2)**

> I don't think that things are necessarily... In reality, those Romans aren't exactly doing too badly for themselves.

For the countries you mentioned: A few centuries of exploiting others for resources and wealth freed them from wrecking the guts out of their own soils with their own hands and enabled them to have the head start on other more "gentlemanly" endeavors. A history of a couple of hundred years of good fortunes is nothing to rave about. All former empires, now they are just doing okay-quite a step down from the glory days-isn't it?. An even that "okay" is getting shaky. Japan's economy is limping, UK is beset with riots by the "doin' okay folks", Italy and Germany aren't exactly going gangbusters either.

- report

antialias_physorg
Nov 04, 2011

Rank: **5 / 5 (1)**

> The dutch do a lot of pirate catching.

And you notice that in no anti-pirate activity worldwide big guns (or missiles) are employed. The railgun would be eminently useless for that type of work. All it would be good for would be coastal

shelling (something that is not being considered anymore as it is much less precise than using cruise missiles or laser guided missiles from drones or planes) .

- report

NotAsleep
Nov 04, 2011

Rank: **4 / 5 (1)**
Antialias, not necessarily true that coastal shelling isn't being considered. Most of the time, the DoD takes total lifecycle costs into account when deciding whether or not to develop a weapons system and, later on, whether or not to continue employing a weapons system. I don't think I need to go into details on the multitude of things considered, suffice to say nothing is ever off the table and I believe this rail gun may take us back to coastal shelling.

The Navy is also developing a tactical laser. In the demo, they were able to destroy the engines of a small boat. It makes me think of Picard telling Worf to fire phasers, target the engines only... anyway, it's not particularly useful yet but is an illustration that military tactics refuse to be constrained by current technology. It will always seek to employ the next best thing while integrating the best things of the past

I'm sure the Dutch Navy already has lasers, tractor beams and photon torpedoes...

- report

antialias_physorg
Nov 04, 2011

Rank: **5 / 5 (1)**
The problam with coastal shelling is that it is of such limited use. You're mainly limited by the direction from which you can do it (which means it is very easy for a potential adversary to station his assets so as to render them immune from shelling by hardening one side or simply placing them so that the line of fire is blocked by something that may not be hit: schools, hospitals, appartments, ... whatever)

Drones, planes and cruise missiles can hit from any direction independently of the site they are launched from - and to a much greater range with only minimally longer warning times.

The time of indiscriminately shelling coastal cities - which is the only thing these guns would be cost effective for - are, hopefully, long gone.

Naval battles in times of war will certainly not include navies getting within 200 miles of each other before commencing hostilities. Such engagement would be decided MUCH further out by other means.

- report

NotAsleep
Nov 04, 2011

Rank: **5 / 5 (1)**

I'm an expert on air warfare, not so much sea warfare, but I know we're at the point that we can shoot missiles and planes out of the sky. I'm not certain we could shoot ultra high speed, solid projectiles out of the sky. Just sayin'...

I also suspect these wouldn't be indiscriminate shots at the coast. I also suspect that they'd have sufficient penetration through all but the most hardened shelters. In war, we don't care as much about the hardened shelters of enemy leaders as we do about the power that supplies their anti aircraft batteries or the communication nodes that allow them to coordinate attacks. Our favorite thing to do is isolate people in hardened shelters: we know where they are and we keep them from doing anything useful

- report

antialias_physorg
Nov 04, 2011

Rank: **4 / 5 (1)**
So what do you do about installations that are more than 200 miles beyond the coast?

Hitting stuff there will require planes/drones/missiles - and since the overflight times will be longer the dangers will be higher than for coastal sorties.

So instead of concentrating on a few complex systems on a ship they add one more with extremly limited value? At the envisioned price tag I'm not convinced this is a good idea.

Since it won't replace any of the other systems, which are all still needed for precision/long range targets, it's also not going to produce any savings.

So there's really only one use left: attack on targets up to 200 miles from the coast. And that scenario hasn't happened for decades. That's it. Is that enough justification to keep pumping money into such a (albeit technically nifty) system?

- report

NotAsleep
Nov 04, 2011

Rank: **5 / 5 (2)**
I'm sure we can go round and round forever on this topic. I can list a hundred reasons it's a good idea just like you can list a hundred it's a bad one, all while neither of us has any technical knowledge of how big/expensive/safe/etc. that the system is.

I have faith that Navy leadership knows what they're doing. All military systems are started based on a military need. Programs get killed either due to funding, obsolescence, impracticability or congressional input. It's possible this program will get put into the dust bin with countless other programs but you can be sure that the concept had a viable mission when it was conceived

- report

antialias_physorg
Nov 04, 2011

Rank: **2.5 / 5 (4)**

> I can list a hundred reasons it's a good idea

You keep saying this but you haven't yet mentioned even one. How about doing so? (I don't need 100. The top ten will do)

> I have faith that Navy leadership knows what they're doing.

What every military-industrial complex is doing: Stashing money nitheir own pockets for products that no one needs.

The 'military need' is manufactured to get the contracts (e.g. all the now debunked lies on missile gaps, submarine gaps, bomber gaps, and whatnot served to foster similar programs which lead to trillions of dollars being spent on tech for which there was never any use or real need)

- report

Nerdyguy
Nov 04, 2011

Rank: **3.7 / 5 (3)**

> I can list a hundred reasons it's a good idea

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Oh, boy, you were going along making reasonable arguments for awhile when your inner troll woke up.

"debunked lies"??? You mean, points you don't agree with.

- report

NotAsleep
Nov 04, 2011

Rank: **5 / 5 (3)**
Haha, I had not expected to return to this thread. Top eleven: Utilizes existing power infrastructure, decreases hazardous weapon load, utilizes inexpensive armament, utilizes high speed armament that cannot be avoided, decreases warning time to enemy, provides high rate of fire compared to missiles, technology can be developed into other mission requirements (i.e. replace gatling guns with EM guns), decreases fire hazard from flash back, likely decreases overall weight of the weapons platform, decreased cost per shot by eliminating propellant, keeps pilots/UAVs safe by keeping them out of action

I ask that you not confuse military need with congressional wrangling. Sometimes we do things we don't want to do because some senator needs more votes. The F-22 and F-35 acquisitions processes are examples (not the jets themselves). The military need itself, however, is NEVER manufactured

- report

TheGhostofOtto1923
Nov 05, 2011

Rank: **5 / 5 (1)**

> Drones, planes and cruise missiles

These are all quickly becoming vulnerable to directed energy weapons. Railguns offer speeds of 2 to 2.5 kilometers per second (4,500 to 5,600 mph) MINIMUM, and a range of about 220 nautical miles MINIMUM (future capability UNLIMITED) with rapid fire capability.

This gives munitions a much better chance of survival to target.

- report

antialias_physorg
Nov 05, 2011

Rank: **not rated yet**

> "debunked lies"

Don't you listen to Congress hearings? I don't live in the US but even I get the historical ones. Russia had (by estimate of the US airforce!) about 4 nukes that could actually be deployed at the time of the purported 'missile gap' when everyone was so scared of thousands of warheads that a massive counter armament program was instituted. (even Kruzchev admits this in his memoirs)

Same with the number of bombers

Same with the number of submarines

You really should open a history book once in a while.
Or try reading the account by George McGovern (at the time member of the House of Representatives and special council to John F. Kennedy)
http://books.goog...;f=false

- report

antialias_physorg
Nov 05, 2011

Rank: **1 / 5 (2)**

> Utilizes existing power infrastructure

This is a reason for developing it? Grasping at straws. This is neither an operational advantage nor any other kind of rationale.

> decreases hazardous weapon load

Not true. It doesn't replace any other weapons system. The hazard stays exactly the same.

> utilizes inexpensive armament

No. The projectiles still have to be (at least) laser guided to be effective.

> utilizes high speed armament that cannot be avoided

As opposed to missiles which miracoulously can be avoided?

> provides high rate of fire compared to missiles

no. These suckers fire slooooowly. recharge times are high because you have to charge up the capacitors and cool down the rail. Missiles fire MUCH faster.

> decreases fire hazard from flash back

You mean 'increase'. Fire is a real problem with these guns. they get HOT. Loads of electricity. Oh boy.

None of your 'reasons' make any sense. For each there is a system that already does this better

- report

Norezar
Nov 06, 2011

Rank: **not rated yet**
Slap some graphene on it, it'll be fine.

- report

NotAsleep
Nov 07, 2011

Rank: **5 / 5 (1)**
Antialias, this is where I stop because you obviouly have no knowledge of the military or their weapons systems. You sound like Michelle Bachman saying vaccines cause autism. Your apparent "gut feel" of how things work is incorrect

- report

TheGhostofOtto1923
Nov 07, 2011

Rank: **5 / 5 (2)**

> No. The projectiles still have to be (at least) laser guided to be effective.

No they dont. Where'd you get this?

> no. These suckers fire slooooowly. recharge times are high because you have to charge up the capacitors and cool down the rail. Missiles fire MUCH faster.

Depends on system configuration. Sure missile batteries can fire faster but then need to be reloaded. Missiles are larger, more complex, and more expensive than railgun munitions.

> You mean 'increase'. Fire is a real problem with these guns. they get HOT. Loads of electricity. Oh boy.

Heavy machine gun barrels needed to be swapped out every 500 rounds or so in sustained fire because they used to get too hot. I assume rails are the cheaper components of these systems and could be changed, or the configuration would consist of multiple launch stations which alternated for servicing.

This is until engrs fixed this limitation, which they always do.

- report

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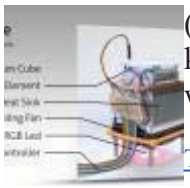

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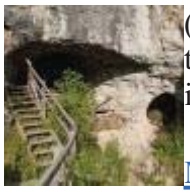

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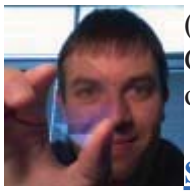

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