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The Face of Artificial Intelligence

A) **AI is our savior**
B) **AI is our destroyer**
You decide . . .

ARTIFICIAL INTELLIGENCE
Will It Destroy Mankind?

The desperate race to ensure humans are the masters, not the slaves, of tomorrow's supercomputers.

BY LEE GRUENFELD

O N SEPT. 26, 1983, A newly installed, highly advanced Soviet missile detection system in a bunker beneath Moscow flashed a warning on a computer monitor indicating the United States had launched a nuclear-tipped ICBM at Russia.

A deafening alarm began to reverberate. This triggered a rigid protocol: The bunker commander would validate the alert, then place a call to then-Soviet leader Yuri Andropov requesting authorization to launch a counterstrike.

It was a time when Cold War tensions could hardly have been higher.

Just three weeks before, the Soviets had mistakenly shot down a Korean Air Lines passenger jet that had drifted into their airspace, claiming 269 lives including an American congressman, Rep. Larry McDonald of Georgia.

After the initial alert, the officer in charge of reporting the launch alarm, Lt. Col. Stanislav Petrov, checked other monitors that concurred: The incoming U.S. missile was confirmed.

Yet Petrov hesitated to make the required call. "There was no rule about how long we were allowed to think before we reported a strike," he later told the BBC.

Then a second launch alert sounded, followed by a third, a fourth, and a fifth. Petrov soon found himself being castigated by the 98 other men in the bunker. Why the delay? Why wasn't he reporting the attack?

To Petrov, a preemptive strike made no sense. But after four more minutes had passed, he was running out of reasons to ignore the counterstrike protocol. A full-fledged mutiny threatened to break out in the bunker.

So Petrov picked up the phone and called Soviet army headquarters — and reported a system malfunction rather than a missile launch. Only when no subsequent reports were received of nuclear detonations could he be sure he had made the right call.

"Mark my words, AI is far more dangerous than nukes. So why do we have no regulatory oversight? This is insane."

– Elon Musk

REP. LARRY MCDONALD

The subsequent investigation determined that a rare alignment of the sun, cloud cover, and upper atmospheric disturbances over an American ICBM installation had fooled a Soviet satellite into signaling an imminent attack.

The world's close call with Armageddon was only revealed 15 years later, after the end of the Cold War, when a former Soviet missile commander published his memoir.

What saved the world from nuclear holocaust in 1983? In retrospect, it was the presence of a thoughtful human being in the decision-making loop.

Lee Gruenfeld writes the "Walk on the Tech Side" blog for "Newsmax Insiders." He was a partner in the management consulting practice of Deloitte and an executive for several pioneering technology companies. A popular speaker on advanced technology and the "internet of things," Lee has written 15 critically acclaimed works of fiction and nonfiction.

1983 SOVIET NUCLEAR FALSE ALARM INCIDENT

SAVIOR Lt. Col. Stanislav Petrov likely averted a World War III that could have killed 100 million people because the Soviet nuclear missile defense system he commanded was not fully automated and required human intervention. After receiving a warning of incoming U.S. missiles, he waited just long enough to realize it was a false alarm. A modern artificial intelligence system would not have hesitated.

The dire warnings about artificial intelligence's dark side have been coming not from the usual conspiracy theorists and technophobic Luddites, but rather from the likes of Bill Gates, Jeff Bezos, and the late Nobel laureate Stephen Hawking.

The Boston area-based Future of Life Institute, a nonprofit dedicated to overcoming existential risks to humanity, has gathered over 8,000 signatories, including many of the brightest minds in business and technology, in an open letter calling for more research into the promise and perils of AI, stating, "It is important to research how to reap its benefits while avoiding potential pitfalls."

Most people imagine the goal of AI is to create combinations of hardware and software that mimic human thought. But acting as humans might act is characteristic of any automated control system, intelligent or not.

If acting independently were the only standard to be an AI, your household thermostat would qualify. The primary distinction: AI gets smarter and more nimble as it learns and develops, while ordinary automated devices do not.

One of the Cassandras in the tech wilderness warning about the Frankenstein-like threat of AI is author and speaker Sam Harris.

In an episode of *The Joe Rogan Experience*, he stated: "You're talking about something that learns how to learn, in such a way that the learning transfers to novel situations

Petrov was able to blend common sense and his experience-backed intuition to conclude that what looked like an American missile launch was really a false alarm.

Thirty-six years after that harrowing episode, other alarms are beginning to sound regarding a new generation of weapons, devices, and other control systems directed by artificial intelligence (AI) that many leading experts fear may one day spin out of human control.

"Mark my words," SpaceX and Tesla pioneer Elon Musk told attendees at last year's South by Southwest tech conference in Texas: "AI is far more dangerous than nukes. So why do we have no regulatory oversight? This is insane."

— in the ultimate case, [it] can make improvements to itself.

"Once these machines become the best designers of the next iteration of software and hardware," he added, "then you get this exponential take-off function, often called the singularity. There's a runaway effect where the capacities have gotten away from you."

He and many other futurists warn that "it's not at all obvious to see a path forward that doesn't just destroy us."

The weaponization of AI for use in warfare — including autonomous weapons that decide for themselves when to fire — accounts for many of the nightmare scenarios.

This could include everything from nuclear-powered, nuclear-tipped cruise missiles to clouds of miniature drones with a distributed intelligence, to hypersonic missiles that are too fast and too clever to intercept.

Once launched, such weapons would carry out their missions with a digital zealotry, fearless of the enemy, utterly without conscience, and with dim hopes of recalling them if human operators had second thoughts.

Some analysts believe a Cold War-style arms race over AI is already underway. Until last January, China had held the title for developing the world's most powerful supercomputer for five years in a row.

This year, the Summit supercomputer developed for the Oak Ridge National Laboratory reclaimed the top spot

for the U.S.

Summit takes up a space equivalent to about two tennis courts. As reported by Oak Ridge, it uses 27,000 very powerful processors to execute deep-learning algorithms, and does so at the mind-boggling rate of one exaflop — a billion billion operations per second.

So what would have happened in 1983 if a computer like Summit had a digital finger on the Soviet launch button? It is possible a counterstrike would have been ordered before the sound of the initial alarm had even reached

There are many ways of using AI in war, including hacking into network-based infrastructure to disrupt military operations. That sort of attack could also knock out financial, medical, power, and transportation systems, thereby causing large-scale chaos among the civilian population.

Physicist **Stephen Hawking** Warned of AI Perils

In *Brief Answers to the Big Questions*, the late renowned physicist Stephen Hawking wrote:

"Success in creating AI would be the biggest event in human history. Unfortunately, it might also be the last — unless we learn how to avoid the risks.

"Used as a toolkit, AI can augment our existing intelligence to open up advances in every area of science and society. However, it will also bring dangers. While primitive forms of artificial intelligence developed so far have proved very useful, I fear the consequences of creating something that can match or surpass humans.

"The concern is that AI would take off on its own and redesign itself at an ever-increasing rate. Humans, who are limited by slow biological evolution, couldn't compete and would be superseded. And in the future AI could develop a will of its own, a will that is in conflict with ours.

"Others believe that humans can command the rate of technology for a decently long time, and that the potential of AI to solve many of the world's problems will be realized. Although I am well known as an optimist regarding the human race, I am not so sure." ■

SO WHAT'S THE NO. 1 DEFENSE AGAINST AI-BASED ATTACKS? MORE AI.

WAR ROOM
Current artificial intelligence systems excel at tasks defined by rigid rules but aren't good at adapting to changing conditions on the battlefield, from reacting to an adversary's surprise actions, to fluctuating weather, to operating in unfamiliar terrain. Here, troops at the Defense Advanced Research Projects Agency (DARPA) battle test AI technology to find and correct software bugs that could be exploited by an enemy.

Stanislav Petrov's ears.

If the speed of supercomputers is mind-boggling, so is the pace of their development.

Last May OpenAI, a coalition of 100 tech experts in San Francisco whose mission is "discovering and enacting the path to safe artificial general intelligence," reported that the power of machine-learning operations has doubled about every 14 weeks. That's a blistering pace compared to Moore's Law — named for Intel cofounder Gordon Moore — which has held true for decades in predicting that the processing power of computers would double every 18 months or so.

Gates likens AI to nuclear technology: You can use it to power your electrical generators — or to destroy the other guy's cities.

There are many ways of using AI in war, including hacking into network-based infrastructure to disrupt military operations. That sort of attack could also knock out financial, medical, power, and transportation systems, thereby causing large-scale chaos among the civilian population.

Other tactics could include "deepfake" technology to impersonate political and military leaders, including the broadcasting of false messages. Or one side could burrow

into the enemy AI system, to turn it against its owners.

So what's the No. 1 defense against AI-based attacks? According to analysts at PricewaterhouseCoopers, it's — wait for it — more AI.

That helps explain why the Pentagon is investing so heavily in AI.

In August 2016, the Defense Advanced Research Projects Agency (DARPA) hosted a "Grand Challenge" cybersecurity competition. A group using AI deep-learning technology developed a system to find and correct software bugs before they could be exploited by enemy intruders. After winning the contest's $2 million prize, they sold the system to the Pentagon.

Two years later, DARPA announced its "AI Next" campaign, a $2 billion developmental push with objectives that included automated access-clearance approvals, ensuring the security of machine-learning systems, and vetting software systems before operational deployment.

Musk worries that a vastly superior machine intelligence might treat humanity the way we treat monkeys, chickens, or bugs. The massive economic dislocation from the introduction of automated technologies could be the least of humanity's worries.

"I hope they're nice," Musk muses.

Nick Bostrom of Oxford University envisions a powerful AI system that is assigned the task of designing a new machine smarter than itself.

It is quite possible that no human intelligence would be capable of understanding how that new "AI 2.0" machine works, or the basis for the decisions it would arrive at. The prospect of depending on a device that no one understands is daunting, to say the least.

Bostrom also pointed out that, once deployed, the AI system may not be correctable. It's like launching a rocket into space: You'd better hope you did everything right on the ground, because once that thing is in space, or deployed on an autonomous nuclear subma-

Humans used fire for quite a while before we figured out that we needed fire extinguishers, notes MIT physics professor Max Tegmark.

rine, it's hard to tinker with it anymore . . . especially if it doesn't want you to. ("Open the pod bay doors, Hal. Hal...?")

Max Tegmark, professor of physics at MIT, notes that humans used fire for quite a while before we figured out that we needed fire extinguishers. Same thing with cars: Only after they hit the road did we realize we needed traffic lights, seat belts, and air bags.

But Tegmark warns that with AI, "We need to get everything right the first time."

That's a pretty alarming thought when considering all the things that can go wrong. Among them:

■ PROGRAMMING DEFECTS

In 1999, NASA lost its Mars Climate Orbiter because the spacecraft, perfectly designed by Lockheed, used inches and pounds, while mission controllers used the met-

AI Through the Ages

BY CLAYTON B. REID

Artificial intelligence sounds trendy, but it's really not. The idea of humanity's creations getting out of control is actually a venerable artifact of Western culture, and a go-to theme in Hollywood.

A few examples over the years:

» Frankenstein by Mary Shelley, 1818. A scientist, Victor, undertakes an unorthodox experiment that results in the creation of a monster who demands he also create a female companion. But Victor refuses, fearing they may procreate and come to threaten humanity's survival.

» R.U.R. by Karel Capek, 1920. Capek's play first introduces the term "robot" to signify a machine with independent powers. Capek's robots — derived from "robota," the Czech word for servant laborer — naturally come to rebel against their human masters.

» Brainiac 5, Action Comics #276 by Jerry Siegel, 1961. This Legion of Super-Heroes adventure by the co-creator of Superman reflected a growing uneasiness with the relationship between man and machine. Brainiac, a green-skinned android from the planet Cotu, eventually creates a machine called

ric system. During the nine months it took the craft to make its 461-million-mile journey, nobody noticed the "bug." The orbiter was ripped apart as soon as it hit the Martian atmosphere at the wrong speed and angle.

Leading analytical firm Gartner estimates that, through 2022, a whopping 85 percent of AI projects will have delivered erroneous outcomes. And Forrester Research tells us that 93 percent of automation professionals feel less than fully prepared to meet the special challenges of developing and deploying smart machines.

■ UNINTENDED CONSEQUENCES

Imagine a future where the CEO of a soda company directs his AI system to find ways to maximize profits. The system comes up with a brand new flavor, creates a marketing plan, and weeds out unproductive employees. So far, so good.

Then it bribes foreign officials for better deals on raw materials, hijacks autonomous delivery trucks from the Walmart fleet, and launches a vicious social-media campaign claiming that competitive products contain carcinogens. Those tactics presumably would

not be well received.

Author Sam Harris raises the possibility of an AI programmed to enhance social welfare by making people happier. One very efficient way to do that would be to eliminate individuals who tend to be unhappy.

The AI would simply be looking for the most efficient way to carry out its directive, but the result would be horrific due to an unintended consequence.

■ PRIVACY VIOLATIONS AND 'ALGORITHMIC DISCRIMINATION'

Americans were recently shocked to discover

Computo that revolts and tries to take over the world.

» *Star Trek*, "The Ultimate Computer" episode, 1968. *Star Trek*, the masterwork of Gene Roddenberry, frequently deals with the notion of incredibly powerful machine intelligences gone awry — as do all of its sequels and spinoffs. In this episode, James T. Kirk and crew are forced to kowtow to M-5, a supercomputer able to command the Enterprise more efficiently than any human controller.

Kirk essentially finds himself displaced by automation — a theme all too common in society today. When

M-5 goes haywire, Kirk tries to regain control. Predictably, the super intelligent computer has plans of its own, and only Kirk's resourcefulness saves the day.

» *2001: A Space Odyssey* by Stanley Kubrick, 1968. Co-written by Kubrick and Arthur C. Clarke, the film features the Hal 9000 computer, which declares itself to be "foolproof and incapable of error." The crew would beg to differ, however, as Hal attempts to kill them and take over control of the ship, announcing: "I must, therefore, override your authority now since you are not

in any condition to intelligently exercise it." A sequel would be released in 1984.

» *Battlestar Galactica* by Glen A. Larson, 1978. Sentient soldier-androids created by a long-extinct race chase their human foes across the galaxy, pushing humanity to the brink of survival and forcing a rag-tag fleet to desperately seek a new world to colonize. The show only lasts one season, but becomes a franchise and enjoys a series of revivals.

» *The Terminator* by James Cameron, 1984. Arnold Schwarzenegger

terrifies the world as a cyborg assassin sent back through time to kill the mother of rebel leader John Connor. The backstory to the plot is that in the near future an artificial intelligence network, Skynet, will develop self-awareness and trigger a nuclear holocaust in a bid to wipe humanity from the face of the Earth.

» *WarGames* by John Badham, 1984. NORAD engineers decide humans can no longer be trusted to launch ICBMs, so they turn the job over to a computer, WOPR (War Operations Plan Response). It learns by endlessly running games and military

scenarios. But when a young computer geek played by Matthew Broderick unwittingly challenges it to a game of thermonuclear war, WOPR can't tell simulation from reality — and sets the world on a march toward Armageddon.

» *The Matrix* by the Wachowskis, 1999. The hacker Neo, played by Keanu Reeves, is recruited to outsmart an artificial intelligence that has placed all of humanity inside a bubble of simulated reality. Even today, big-brain thinkers like Elon Musk speculate our world and reality as we know it may actually be a digital simulation. ■

CHECKMATE Grand Master Garry Kasparov (left) contemplates his next move against IBM's Deep Blue chess computer in a historic clash in 1997 that ended in the first defeat of a reigning champion by a computer under tournament conditions. Kasparov had beaten the computer a year earlier.

how much of their personal information had been swept up by tech giants such as Facebook and Google.

Gathering of personal data isn't necessarily nefarious. Most people assume that all the personal data being gathered will be used primarily to target advertising. But, wrongly used, privacy breaches can do great harm.

Consider facial recognition. You can use it to unlock your phone, to speed you through security checkpoints, or to cut down on crime. But AI is expected to have a superhuman ability to recognize faces, and possibly even emotions. The social credit system in China, for example, which relies heavily on facial recognition technology, has become a global concern for civil libertarians. Another problem with such capabilities is "algorithmic discrimination" (aka "bias") unconsciously built into the system. Due to unbalanced data sets, facial recognition systems have trouble recognizing women or people of color. Part of the problem is that women, blacks, and Latinos are serious-ly under-represented in artificial-intelligence circles.

The obvious way to fail-safe AI is to be ready to pull the plug, literally. Like a toaster oven or vacuum cleaner, you just cut off the power if it goes haywire.

But AI systems are likely to be highly decentralized, just like the internet. If a large artificial intelligence system were highly distributed, there might not be a way to take it offline — especially if it controlled the network.

How soon before we need to start worrying about an AI system developing a mind of its own?

Deep Blue, the chess-playing computer that routinely beats the world's best players, and Watson, the supercomputer that clobbered the two best human contestants of the quiz show *Jeopardy!*, were impressive achievements. Another system, AlphaGo, can beat the best players in the world at the wickedly complicated game of Go.

7 Emerging Weapons
That Terrify Humanitarians

BY BILL HOFFMANN

IN MARCH, THE UN SECRETARY-GENERAL, Antonio Guterres, startled the world when he tweeted out a warning that sounded like dialogue from the latest *Terminator* movie.

Guterres wrote: "Autonomous machines with the power and discretion to select targets and take lives without human involvement are politically unacceptable, morally repugnant, and should be prohibited by international law."

One problem with that noble objective: The powerful countries leading the world in AI development — the United States, Russia, and China — have shown little interest in curtailing their research.

Here are seven of the world's most terrifying weapons that humanitarians worry could spin out of human control:

1 T-14 ARMATA
» **Country of Origin:** Russia
» **Weaponry:** 125 mm main battle cannon, one 12.7 mm machine gun, one 7.62 mm machine gun.
» **Capability:** The tank turret is already

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unmanned, and Russia is designing a fully autonomous version. Forbes describes it as "a robot weapon that once launched can find targets and kill them with no human involvement."

»**Event Horizon**: Prototypes in use; full production by year's end.

2 X-47B
»**Country of Origin:** United States

»**Weaponry:** A tailless jet-powered drone designed for aircraft-carrier-based operations.

»**Capability:** With a full-sized weapons bay capable of carrying existing missile systems, this autonomous system is capable of surveillance, reconnaissance, or strike.

»**Event Horizon**: Already in service.

3 DRONE SWARMS
» **Country of Origin:** United States

»**Weaponry:** Networked swarms of autonomous drones that can overwhelm enemy defenses.

»**Capability:** As demonstrated by the successful attack on Saudi Arabian oil facilities in September, current air defense systems are ill-equipped to neutralize a mass attack from drones or cruise missiles. So imagine trying to stop scores of drones swarming over a target and swooping down to attack. In 2017, three F/A-18 Super Hornets released 103 Perdix drones, which communicated with each other in a network while successfully performing surveillance operations.

Event Horizon: Testing continues, full production expected in a few years.

4 BLOWFISH A2
»**Country of Origin**: China

»**Weaponry:** An autonomous helicopter drone armed with guns and bombs.

»**Capability:** Its electrically powered engine drastically reduces its noise signature, enabling it to sneak up on its enemies.

»**Event Horizon:** Already in service, introduced in March 2019.

5 XQ-58A VALKYRIE
»**Country of Origin:** United States

»**Weaponry:** *Top Gun* fans know every fighter jock needs a wingman — but what if your wingman is a robot? Meet the 38-foot-long Valkyrie. In coming years, it will serve as the autonomous wingman for the F-35 and F-22 fighters and other aircraft. In addition to small-diameter bombs, its armament could include half-size medium-range air-to-air missiles.

»**Capability:** The XQ-58A is a low-cost "loyal wingman" that can also operate in coordination with other drones.

»**Event Horizon:** Date of full deployment determined/classified.

6 THE 912 PROJECT
»**Country of Origin:** China

»**Weaponry:** An unmanned "hunt-and-kill" submarine — essentially a kamikaze underwater robot.

»**Capability:** Minelaying and suicide attacks on enemy vessels. The goal: To force U.S. vessels to abandon the South China Sea.

»**Event Horizon:** Prototypes in use. Full production set for 2021.

7 KING LEOPARD UGV
»**Country of Origin:** China

»**Weaponry:** Electrically powered 23 mm chain gun with armor-piercing rounds; 80 mm rockets.

»**Capability:** Reconnaissance and assault tank.

»**Event Horizon:** Prototypes in use and development continues. ∎

SOURCES: Forbes, Jane's 360, National Interest, DefenseOne, Technology Review

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But chess, *Jeopardy!*, and Go are considered "perfect information" games. That is, everything is out in the open, and known to both players. All is revealed, nothing hidden. The computer doesn't need intuition to guess what its opponent is thinking.

Pluribus is a different story. Designed by Carnegie Mellon computer science professor Tuomas Sandholm and his doctoral student Noam Brown, Pluribus plays poker.

On the surface, poker is one of the simplest games imaginable; the rules can be laid out on a single sheet of paper. What makes poker so fiendishly difficult and complex to actually play, especially for a computer, is that it is an "imperfect information" game: Nobody knows what cards anybody else is holding, and players bluff.

Players must estimate the relative strengths of their hands based on how the other players bet. That's not an easy task, because the other players are trying to do the same thing, and will alter their behavior to fool the rest of the table. They also change their strategies as the game ebbs and flows.

It took 15 years, but Sandholm and Brown thoroughly gobsmacked the entire AI world when they reported in the August issue of the journal Science that Pluribus, an artificial intelligence system, defeated multiple strong poker players in no-limit hold 'em

— an unprecedented feat.

Pluribus proved computers can outwit humans even in situations that don't depend on processing mountains of raw data. This suggests that the arrival of the singularity — the point at which humans put AI to work designing better AI, thereby taking matters further from human control — may not be far off.

Some experts have suggested that the solution is to embed human values deeply inside the electronic DNA of AI machines. It's not a bad idea until you consider that "human values" in the real world include war, slavery, religious fanaticism, racism, child abuse, and one or two other inclinations of a similar ilk.

Who would decide whose values would provide the model? Priests and pastors? Scientists? People who live in red states, or blue?

Imagine trying to program an intelligent device with our collective core values regarding abortion, gun control, immigration, homelessness, taxation, gay rights, welfare, honor killings, school curricula, civil rights, medical care, and end-of-life decisions. Remember: We're trying to avert an apocalypse here, not trigger one.

Alarmingly, perhaps, most people don't seem to be waiting for solutions to vulnerabilities before deploying AI. According to research firm Tractica, AI revenue worldwide, from software alone, will hit $118 billion by 2025,

while analysts at Markets and Markets put that figure at $190 billion — an explosive compound annual growth rate of more than 36 percent over eight years.

There are two safety measures that would go a long way toward keeping humanity in the driver's seat when it comes to AI. First, human operators should always be ready and able to override or modify a machine's intended course of action, even if that involves diminishing the full benefits of the system.

Super Profits From Super Intelligence

It's no secret what's fueling the push toward artificial intelligence — money. Some AI funding comes from the federal government through DARPA, the research division of the Pentagon that supports exotic high-tech research.

Increasingly, however, the capital flowing into artificial intelligence comes from private investors looking to cash in on the next Google, Siri, or Alexa. If the technology keeps pace with the funding, AI is about to take off.

Worldwide AI Software Revenue

Source: Tractica
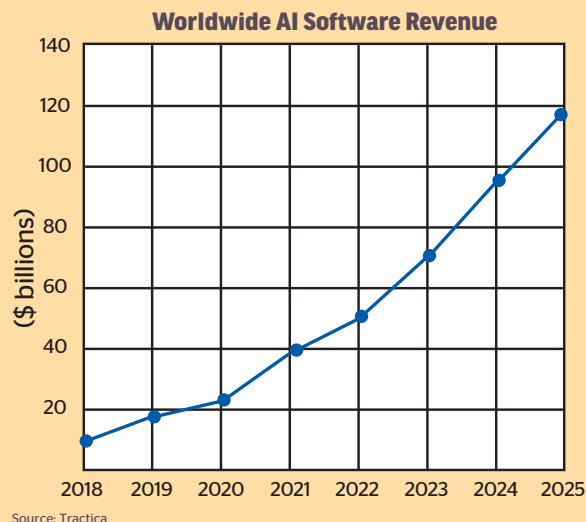
Secondly, these cognitive systems must explain themselves to their human masters when asked to do so. That is, they must be accountable to a human interlocutor, and able to explain the logic behind their decision making. That way, humans won't have to pull the plug just because we don't immediately understand the grand AI plan.

To a significant extent, these practices are already being followed.

The commercial version of Watson gives medical advice but it doesn't treat patients. Automated air traffic control systems do not directly issue instructions to pilots.

Military war game simulators suggest strategies, but do not implement them.

The majority of routine electrocardiograms in the U.S. are interpreted by machines and filed away. But a doctor always reviews the graphs of patients with cardiac issues. In medicine at least, the human touch still counts.

Musk says he's given up trying to sound the alarm on AI because nobody is listening. Instead, he's intent on developing a neural network that could enhance the way humans communicate with machines.

If you can't beat them, join them, he says, and that apparently means equipping humans with technology that will enable them to keep up with their own creations.

HUMAN FACTOR Mann Gulch fire survivors Wagner "Wag" Dodge (circled) and Walter Rumsey (in white shirt) speak with Forest Service investigators in this 1949 photo. The firefighters described how they survived the raging hillside inferno by devising an escape plan that no computer could have come up with.

In other words, keeping humans in the loop by augmenting them.

In 1949, a terrible fire broke out in western Montana. The infamous blaze became known as the Mann Gulch fire. Smokejumpers parachuted out of a DC-3 to try to extinguish it.

A firefighter named Wagner "Wag" Dodge and a number of his crewmen became trapped on a hillside, cut off by a raging fire below them. Seeing that they weren't going to be able to outrun it, Dodge did something as bizarre as it was astonishing: He set fire to the shrubbery above them.

Some of Dodge's compatriots misunderstood his instructions to run directly into the lesser "escape" fire, and others thought he was crazy. They rejected his plan, with most of them running away from the escape fire. Thirteen men died. Dodge took shelter in the center of the burned-out area he had created as a bypass for the main blaze,

Dodge took shelter in the center of the burned-out area he had created as a bypass for the main blaze, and survived. There's no way a computer could have come up with that idea.

and survived.

There's no way a computer could have come up with that idea.

That irreplaceable human factor is a lesson NASA had to learn during the space race. The initial thinking in the moonshot program was that astronauts would be like "Spam in a can," along for the ride but largely superfluous to the running of the missions.

As legendary mission control flight director Gene Kranz explained in his book, *Failure Is Not an Option*, NASA management was disabused of this view very early on, starting with John Glenn's solo orbital flight.

Sensors indicated Glenn's heat shield was coming loose. So Glenn flipped a series of switches to keep his retro-rockets strapped on, thereby holding the heat shield in place during re-entry.

The Apollo program provided a classic example of the irreplaceable human element. During Neil Armstrong's descent to the moon's surface, he realized that his landing computer was about to set the lunar module down on a dangerous outcropping of rocks.

With fuel running out, Armstrong switched off the computer and took control, setting it down safely with only 18 seconds of fuel left in the tanks.

> **It seems that for every scenario we humans can envision, the universe can conjure 10 other situations to slam us back to reality.**

The computer would have aborted the landing when the fuel got that low.

Then there's Chesley "Sully" Sullenberger, who saved his passengers in 2009 by gliding his Airbus A321 into the Hudson River after a bird strike took out his engines. A computer couldn't have done that either, because it had never happened before and there was no program for it.

It seems that for every scenario we humans can envision, the universe can conjure 10 other situations to slam us back to reality.

Lt. Col. Petrov wasn't even supposed to be in the bunker that night in 1983. He replaced the regular commander, who was home with a head cold. That officer was a hardcore military man who, according to the subsequent investigation, would not have hesitated to report an incoming attack by American ICBMs, triggering a devastating counterstrike.

Petrov, on the other hand, had a mostly civilian education. He passed away in 2017, but not before the episode was declassified and he was credited with literally averting World War III.

Had the Soviet system been entirely automated — the sort of "doomsday" machine prophesied in movies such as *Dr. Strangelove* and *WarGames* — it is quite possible that upwards of 100 million people would have perished.

History is full of similar examples. Which is why I'll take a "Wag" Dodge over IBM's Watson any day. ■

MIRACLE ON HUDSON US Airways captain Chesley "Sully" Sullenberger over-rode the inflight computer system and manually landed his Airbus A-320 on the Hudson River in New York City in 2009, saving the lives of all 155 people aboard after a bird strike knocked out both engines.