The Pentagon's Brain DARPA

Castle Bravo-the prerecorded voice of Barney O'Keefe came over the loudspeaker, counting down the last seconds. Everyone fell silent. "Five. Four. Three. Two. One" Zero hour. A flash of thermonuclear radiation filled the air. The presence of x-rays made the unseen visible. In the flash of Teller light, Freedman-who was watching the scientists for the reactions-could see their facial bones. "In front of me…they were skeletons," freedman recalls. Their faces no longer appeared to be human faces. Just "jawbones and eye sockets. Rows of teeth. Skulls."

Out at the sea and in the distance, the world's largest ever nuclear fireball-nearly four and a half miles in diameter and nine miles tall-lit up the sky. So intense was the fireball that Navy personnel manning a weather station 155 miles to the east watched, awestruck, as the dark sky remained alight for sixty agonizing seconds. Next, the mushroom cloud started to form. Freedman's eyes remained on the Los Alamos scientists, his own perspective now returned to normal in the absence of the Teller light. "I was watching their faces," he recalls, "to see their reaction. Most had their mouth open, with the eyeballs darting back and forth. I remember the eyes. The eyeballs kept moving. There was fear and terror, I think. The mushroom cloud just kept getting bigger." The scientists knew something was wrong. One scientist held two fingers up in front of his eye, trade craft among nuclear weapons engineers to roughly measure the rate of expansion of a mushroom cloud. What was predicted to be a 6 megaton explosion had gone out of control. Castle bravo was a 15-megaton explosion. No one had any idea the explosion would be this big. "the mushroom cloud should have been 15 or 20 miles wide at this point. Instead, it was 40," freedman explains. "As the cloud kept growing behind me, I could see in the faces of the scientists thought the atmosphere was catching on fire. The look said, "this is the end of the world."

Time passed. Freedman stared at the horrified scientists. Then finally, the rapid expansion of the mushroom cloud began to slow. To freedman's eye, the scientists expression of intense terror and despair suddenly lifed and was gone. "the look on their faces went from fear to satisfaction," freedman recalls. "The world didn't end and they were triumphant. Self-satisfied with what they had accomplished. What they had done."

It was McElroy's idea to run soap ads on daytime television when many American housewives watched TV. By 1957, P&G soap sales had risen to $1billion a year, and Mcelroy would be credited with inventing the concept of the soap opera. "Soap operas sell lots of soap." He famously said. Now McElroy was the secretary of defense under Eisenhower. He took office with a clear vision. " I conceive the role of the secretary of defense to be that of captain of president Eisenhower's defense team", he said. His first job as captain was to counter the threat of any future Soviet scientific surprise after Sputnik.

“Seesaw was a sensitive, limited access project which deserves mention in ARPA history as the most enduring specific project ever supported by the agency,” and agency review stated. In 1974 it was transferred to the Atomic Energy Commission, Some unclassified summaries have been released. Over the next 55 years, ARPA’S directed energy weapons programs would develop and grow. The majority of them remain highly classified. “Directed energy is the weapon of the future,” said retired four star general Paul F. Gorman in a 2014 interview for this book. “But that is a sensitive area, and we can’t get into that.”

Secretary of Defense Charles Wilson suggested an “all-out campaign to smear the Koreans.” Defense department officials had a very specific name for what the communists were doing to our soldiers, a word recommended by the CIA. The communists were “brainwashing” American soldiers, the Pentagon said. It was a CIA move that was 3 years in the making. In fact, the word “brainwashing” had entered the English lexicon in September 1950, courtesy of the CIA, when an article written by a reporter named Eddward Hunter appeared in a Miami newspaper the NEWS. “Brain washing tactics force chinese into ranks of communist party,” the headline read. Although Hunter had been a journalist for decades, he also worked for the CIA. He’d been hired by the agency on a contract basis to disseminate brainwashing stories through the mainstream press. “Brain washing,” wrote Hunter, was a devious new tool being used by the communists to strip a man of his humanity and “turn him into a robot or a slave.” The very concept grabbed Americans by the throat. To be incinerated in a nuclear bomb attack was an ever present cold war threat, but it was also an abstraction, difficult to conceptualize on an individual scale. In 1950, the idea of being brainwashed, as if controlled by an evil wizard’s spell-that was somehow much easier to relate to. Brainwashing terrified people, and they want to know more.

The first mission to spay herbicides on the jungles of Vietnam occurred on august 10, 1961. The helicopter-an American made H-34 painted in the colors of the south Vietnamese army and equipped with an American made spray system called a HIDAL (helicopter insecticide dispersal apparatus, Liquid)-was flown by a south Vietnamese air force pilot. President diem was an enthusiastic advocate of defoliation, and 2 weeks later he personally chose the 2nd target.

In October 1962, a quiet 47 year old civilian scientist from Missouri arrived a the pentagon to begin a new job with the advanced research projects agency. His work would change the world. By 2015, 3 billion people on the planet would regularly use technology conceived of by him. The man, J.C.R Licklider, invented the concept of the internet, which was originally called the ARPANET.

Licklider imagined a time in the future when man and machine might interact and problem solve to an even greater degree. He wrote a paper outlining his concept, called “man-computer symbiosis”, in which he described a partnership between humans and “the electronic members of the partnership,” the computers. Licklider envisioned a day when a computer would serve as a human’s “assistant.” The machine would “answer questions, perform simulation modeling, graphically display results, and extrapolate solutions for new situations from past experience.” Like John von Neumann, Licklider saw similarities between the computer and the brain, and he saw a symbiotic relationship between man and machine. Humans could then devote their time to making important decisions, Licklider said. Licklider believed that computers could one day change the world for the better. he envisioned “home computer

consoles," with people sitting in front of them, learning just about anything they wanted to. He wrote a book, Libraries of the future, in which he described a world where library resources would be available to remote users through a single database. This was radical thinking in 1960.

"Guess how many nuclear missiles were detonated during the Cuban missile crisis?" asks Paul Kozemchak, special assistant to DARPA director Arati Prabhakar, during an interview for this book. Kozemchak is a 37 year veteran of DARPA, which makes him the longest serving employee in its history. "I can tell you that the answer is not 'none," said Kozemchak. "the answer is 'several'." In this case "several" refers to four. By the time of the Cuban missile crisis, Eisenhower's test ban had failed, and the US and the soviet union had both returned to nuclear weapons testing. Twice during the height of the Cuban missile crisis, on October 20 and October 26, 1962, the US detonated 2 nuclear weapons-code named Checkmate and Bluegill Triple Prime-in space. These tests, which sought to advance knowledge in ARPA's pursuit of the Christofilos effect, are record and are known. What is not known outside defense department circles is that in response, on October 22 and October 28,1962. The Soviets detonated 2 nuclear weapons in space, also in pursuit of the Christofilos effect.

If nuclear weapons were to be used against the Ho Chi Minh trail, the jasons concluded, they should be tactical nuclear weapons, lightweight and portable like the Davy Crockett nuclear weapon, a mockup of which Herb York had transported from California to Washington D.C., in his carry on luggage aboard a commercial flight in 1959.

McNamara's electronic fence, which the jasons called an "anti-infiltration barrier," was constructed along the Ho Chi Minh trail, at a cost of $1.8 billion, roughly $12 billion in 2015,

In May 1977 and international treaty, the convention on the prohibition of military or any other hostile use of environmental modification techniques, would be signed, in Geneva, by 48 nations. Until then, weather modification schemes were pursued.

The advancement of command, control, and communication technology relied heavily on computers. Since 1965 the power of microchips, then called integrated electronic circuits, had been doubling every year, a concept that a computer engineer named Gordon E. Moore picked up on and wrote about in Electronics magazine. In "cramming more components into integrated circuits," moore predicted that this doubling trend would continue for the next ten years, a prescient notion that has since become known as Moore's law. Doubling is a notion that has since become known as Moore's law. Doubling is a powerful concept: 10x10=100: 100X100=10,000; 10,000X10,000=100 MILLION. In 2014, apple put 2 billion transistors into its iphone 6.

Through networking, not only would individual computer users have access to other users' data, but also they would be able to communicate with one another in a radical new way. Licklider and Taylor cowrote an essay in 1968 in which they predicted, "in a few years, men will be able to communicate more effectively through a machine than face to face." In 2009, more electronic text messages would be sent each day than there were people on the planet.

The laser was invented in the late 1950s by Charles townes, who in 1964 was awarded the Nobel prize in physics. In the most basic sense a laser is a device that emits light. But unlike with other light sources, such as a lightbulb, which emits light that dissipates, in a laser the photons all move in the same direction in lockstep, exactly parallel to one another, with no deviation. To many, the laser is something straight out of science fiction. In a 2014 interview for this book, Charles townes, then age 98, confirmed that he had been inspired to create the laser after reading Alexei Tolstoi's 1926 science fiction novel THE GARIN DEATH RAY. "this idea of a flashing death ray also has a mystique that catches human attention," said townes, "and so we have Jobe's bolts of lightning and the death rays of science fiction". A half century after Tolstioi wrote the GARIN DEATH RAY, George lucas modernized the concept with Luke Skywalker's light saber in the science fiction film STAR WARS.

One of the first sets of experiments involving lasers, mirrors, and space took place in 1969 and has been largely lost to the history books. The experiment began on july 21 of that year, said townes, when, for the first time in history, two men walked on the moon. While on the lunar surface, "astronauts neil armstrong and Edwin BUZZ Aldrin set up an array of small reflectors on the moon and faced them toward the earth." Back her e on earth-which is 240,000 miles from the moon-2 teams of astrophysicists, on team working at the university of california's lick observatory on Mt. Hamilton, and the other at the university of texas's mcdonald observatory, on Mt. Locke, took careful notes regarding where, exactly, the astronauts were when they se down the mirrors. "about ten days later, the lick team pointed the telescope at that precise location and sent a small pulse of power into the tiny piece of hardware they had added to the telescope," said townes. Inside the telescope, a beam of "extraordinarily pure red light" emerged from a crystal of synthetic ruby, pierced the sky, and entered the near vacuum of space. A laser beam. Traveling a the speed of light, 186,000 miles per second, the laser beam took less than 2 seconds to hit the mirrors left behind on the moon by Armstrong and Aldrin, and then the same amount of time to travel back to earth, where the lick team "detected the fain reflection of its beam," explained townes. The experiment delivered volumes of scientific data, but one was truly phenomenal. "the interval between launch of the pulse of light and its return permitted calculation of the distance to the moon within an inch, a measurement of unprecedented precision," said townes. The laser beam was able to measure what stargazers and astronomers have wondered since time immemorial; exactly how far away from earth is the moon?

We played internal look in late july 1990, setting up a mock headquarters complete with computers and communications gear at Eglin air force base," general Schwarzkopf wrote in his memoir. And then to everyone's surprise, on the last day of the simulated war game exercises, on august 4, 1990, Iraq invaded Kuwait-for real. It was a bizarre turn of events. Science and science fiction had crossed paths once again. Months later, after the gulf war began and ended, general Schwarzkopf commented on how strangely similar the real war and the simulated war game had been.
"as the exercise(i.e. the gulf war) got under way," general Schwarzkopf said, "the movements of iraq's real world ground and air forces eerily paralleled the imaginary scenario of the game."

" I saw the bomb go through the cross-hairs and penetrate and the bunker. The explosion came out of the hole the bomb had made and blew out the doors of the bunker." Feest's bomb hit and destroyed one half of the Iraqi air defense center at Nukayb. "the video game was over," Feest recalled thinking. Except this was not a video game. This was war, and Major Feest had dropped the first bomb.

Ten additional F-117As were on their way to drop bombs on targets in downtown Baghdad. In the first twenty four hours of the war, a total of forty two stealth fighters, which accounted for only 2.5 percent of the U.S. airpower used in the campaign, destroyed 31 percent of Iraqi targets. This was technology in action and it gave the U.S. not only tactical advantage but a psychological one as well. stealth was like a silver bullet. It had allowed U.S. fighter jets to sneak into Iraqi airspace, destroy the country's air defense system, and leave it without a loss. Still, Iraqi president Saddam Hussein declared, "the great showdown has begun! The mother of all battles is under way."

"there had been and initial positive test result indicating a botulinum toxin attach on the white house," Cheney revealed in his memoir. " if the result was confirmed, it could mean the president and I , members of the white house staff, and probably scores of others who had simply been in the vicinity had been exposed to one of the most lethal substances known to man," Botulinum toxin was deadly neurotoxin for which there was no reliable antidote or cure. It kills by attacking the central nervous system and causing death by paralysis. The positive hits had come from the BASIS sensor system that had been installed throughout the white house complex shortly after the DARK WINTER bioterrorism attack war game. Livermore and Los Alamos had promoted the BASIS system as being able to deliver "a virtually zero rate of false positive detection." Cheney also knew that "a single gram of botulinum toxin, evenly dispersed and inhaled, can kill a million people." He needed to call the president but decided to have scooter libby get a second set of test results first.

An IED is made up of five components: the explosive, a container, a fuse, a switch, and a power source, usually a battery. It does not require any kind of advanced technology. With certain skills, an IED is relatively easy to make. The primary component of the IED is the explosive material, and after the invasion, Iraq was overflowing with explosives. "There's more ammunition in Iraq than any place I've ever been in my life, and it's not securable," General John Abizaid, commander of the U.S. Central command (CENTCOM) , told the Senate Appropriations Committee in September 2003.

Scales wrote in the Armed Forces Journal, "understanding and empathy will be important weapons of war." Then he made a bold declaration, "WWI was a chemists' war," Scales said. "World war 2 was a physicists' war," and the war on terror was "the social scientists war." It was as if the Vietnam war had produced amnesia instead of experience. On its official website, the U.S. Army erroneously identified the new Human Terrain System program as being "the first time that social science research, analysis, and advising has been done systematically, on a large scale, and at the operational level" in a war.

One of the drones in the HURT program was the Wasp, a tiny unmanned aerial vehicle with a fourteen inch wingspan and weighing only 430 grams, or less than a pound. Providing real time overhead surveillance to soldiers on the ground, a fleet of Wasps took to the airspace over Iraqi cities and supply routes. The Wasp was one of the smartest drones in the drone fleet in 2005. Powered by batteries, it

flew low and carried and exceptional payload of technology packed inside, including a color video camera, altimeter, GPS, and autopilot. The Wasps worked together in the system of systems, bird-sized drones flying in pairs and in threes.

The longer term goal of Task force troy was to turn the bomb detection and defusing technology over the Iraqis themselves. “we were trying to establish a partnership with the Iraqi ministry of police, but we got a lot of pushback,” marsh recalls. “we’d say here’s how DNA works. Here’s how fingerprinting works. And they’d look at us like we were talking about magic.” In Marsh’s experience, the way the Iraqi police force worked in 2006 was based on a man’s word. “they’d ask someone, a suspect, ‘Did you build this IED?’ And if he said ‘no’, that worked for them. Proof to them was an eyewitness. Judges would ask, ‘Are there any eyewitnesses to back this up?’ if the answer is no, and (the suspect) said he didn’t do it, he would be let go. The system was based on deceptions. On a lot of untruths.”

Marsh learned that security forces were relying on a device to detect bombs that had no science behind it at all. Word was the device, called the ADE 651, “was a totally bogus piece of equipment,” he says. It was a small handheld black box with a swiveling antenna attached to the top. The Iraqi Ministry of the Interior’s general directorate for combating explosives had purchased more that 1500 of the devices from a private company in England called ATSC.

The human terrain system program was controversial from the start. The American anthropological association, which was founded in 1902, and whose credo for anthropologists was “first do no harm,” denounced the program as a “a disaster waiting to unfold.” Its executive board condemned the human terrain system as “a problematic application of anthropological expertise, most specifically on ethical grounds,” and in a letter to congress called the program “dangerous and reckless” and “a waste of the taxpayers money.” It was called “mercenary anthropology”

As commander in chief, the president had twice endorsed significant department of defense reports, “Unmanned Systems Integrated Roadmap FY 2011-2036” and “Unmanned Systems Integrated roadmap FY 2013-2038,” which called for the amplification, not the curtailment, of the Pentagon’s pursuit of robotic warfare. These two reports, roughly three hundred pages in total, made clear that Pentagon drones were positioned to tlead the way forward over the next 25 years of war.

In the very heart of Washington DC, sits a public park called Lafayette square, so named to honor the revolutionary war hero the Marquis de Lafayette. It was here, during an antiwar rally in the fall of 2007, that Bernard crane, a prominent Washington DC attorney, saw one of the strangest things he had ever seen in his life. “my daughter had asked me to take her to the demonstration, so I did,” Crane explains. “ I certainly wouldn’t have been there on my own. I was half paying attention to what was goin on onstage and half looking around when I saw three incredibly large dragonflies overhead,” says Crane. “they moved in unison, as if they were in lockstep. My first thought was, ‘Are those dragonflies mechanical? Or are they alive?’”
“All 3 moved together,” says crane. “they would move to the left together, then they would move to the right together,” it was bizarre. “I had just returned home from a two week vacation at a lake house in maine,” crane says. “I’d spent a lot of my time lying on my back watching dragonflies. I’d become

familiar with how they move. How they hover. How they generally fly alone. Dragonflies are not like carpenter ants. They don't do the same thing as the next dragonfly over, certainly not at the same time."

DARPA's biohybrid programs remain shrouded in mystery. Biohybrid military applications are largely classified, but a few prototype programs have been unveiled. As a nanobiotechnology advanced int eh early years of the twenty first century, tiny machines could realistically be wired into animals brains, bodies, and wings. Starting in 2002, DARPA began periodically releasing incremental information into the public domain. That year news of an early prototype emerged from a DARPA funded laboratory at the State University of New York's down state medical center in Brooklyn, led by researcher Sanjiv Talwar. Scientists implanted electrodes in the medial forebrain bundle of a rat's brain, a region that senses reward. Wires the size of a human hair connected the electrodes to a microprocessor sewn onto the rat's back, like a backpack. From a laptop 500 meters-a third of a mile-away, Talwar and his team of scientists sent electronic pulses to the rat's medial forebrain. After using Pavlovian techniques to train the rat to respond to stimuli, DARPA scientists were able to control the rat, steering it left, right, and forward through a maze via brain stimulation.

Over the next 5 years, DAPRA's biohybrid programs advanced at an astonishing pace. Microprocessor technology was doubling in capacity every 18 months. By June 29, 2007, when Apple rereleased its first generation iPhone, Americans could now carry in their pockets more technology that NASA had when it sent astronauts to the moon.

DARPA's LANdroids (local area network droids) program is one of the smallest of the tread borne robotic ground systems. LANdroids are "small, inexpensive, smart robotic radio network relay nodes" that work in a fleet, or swarm, says DARPA. These hand size robots are dropped by dismounted soldiers as they deploy into urban combat zones, capable of leveraging their stealth and mobility "to coordinate and move autonomously" on their own. If one of the LANdroids is destroyed in battle, the others rearrange themselves accordingly. The LANdroids program aims to develop "intelligent autonomous radio drones," a concept that is critical to understanding where the Pentagon's army of robots is headed over the next 25 years. "the program seeks to demonstrate the capabilities of self-configuration, self optimization, self healing, tethering, and power management," according to DARPA. In this sense, DARPA'S LANdroids program is a prototype for future robotic systems that aim toward autonomy, or self governance. Autonomy lies at the heart of the Pentagon's newest revolution in military affairs. To be clear about what
"autonomy" is, the concept is spelled out by the Pentagon, using a drone as an example:
"When an aircraft is under remote control, it is not autonomous. And when it is autonomous, it is not under remote control". It governs itself.

Vice chairman of the joint chief of staff james A. Winnefeld made this explicit in the pentagon's drone warfare report: "the autonomous systems are self directed toward a goal in that they do not require outside control, but rather are governed by laws strategies that direct their behavior." The nontechnical term for any autonomous drone is a hunter killer robot, a robotic system "intelligent" enough to be shown a photograph of a person and told to return when the target has been killed.

This is science, not science fiction. It is also pentagon policy. Department of defense directive 3000.09, "autonomy in weapon systems," released in 2012, mandates that "autonomous and semi autonomous weapon systems shall be designed." And like all advanced scientific endeavors, the technology must evolve from vision to reality. It is DARPA's job to lead the way. "DoD envisions unmanned systems seamlessly operating with manned systems while gradually reducing the degree of human control and decision making…with and ultimate goal of full autonomy."

Dr. Kenyon, office at Los Alamos, work on artificial intelligence and is part of the synthetic cognition group at Los Alamos Nation laboratory. He and his team are simulating the primate visual system, using a supercomputer to power the operation. Specifically, the team is trying to create a precise computer model of the human eye, including all of its neural networks, to understand the relationship between visual cognition and the brain. This is not necessarily an impossible task, but it does require one of the fastest computers in the world to model such a complex neural network as that of the human eye. Neuroscientists currently believe that there are 100 billion neurons inside a human brain and that every sensor message the brain receives involves and exponential number of neural connection between these networks. To do their work, Dr. Kenyon and his team use a part of the IBM Roadrunner supercomputer, or what is left of it. When roadrunner was built in 2008 it was the fastest computer in the world, able to perform 1 million billion calculations per second. In 2014, the world's fastest supercomputer, located at China's National university of defense technology and called Tanhe-2, could reportedly perform some 30 quadrillion calculations per second, or 33.86 perhaps.

Dr. Kenyon explains the concept behind the DARPA funded project he is working on, in layman's terms. " today, my twelve year old daughter reprogrammed my smart phone so it has facial recognition software," he says. "But seventy to eighty percent of the time it doesn't recognize me." he holds up his phone to his face. "the smart phone can't always see it's me. I can see it's me. there's the double chin, like or not. So why can't my phone recognize me all the time? Why can't it perform a function that my don can, the minute I walk in the door? For all the things the smart phone can do, it can't do the simplest things that biological systems can. Recognize someone all the time." Kenyon notes that if a person's teenaged child recognizes him only 70-80 percent of the time, there would be something seriously wrong with the child's brain. "Sentient beings recognize through sight," he explains. "my phone on the other hand, is just comparing a set of stored features with a set of features extracted from the input coming from its camera. It's not' seeing 'anything. My phone is not resolving the pixels into a rich scene, with all the key points and constructing a high dimensional feature vector that it can compare to a stored feature vector." Primate visual recognition system recognizes things "computers are blind and cannot see"

"regeneration is really coming alive now," Dr. Gardiner says, "Sue and I have been studying the science for years. DARPA was the first time anyone ever asked us to regenerate anything. They did this with the mouse digit," he says, referring to the tip of a mouse finger, which they and another team of scientists had been able to get to grow back, thereby setting a scientific milestone. "DARPA said, 'Great. can you scale it up?' As in pigs. As in humans. They asked, ' Is this possible'? We said yes. They asked, 'do you know how to do it?' We said no. They said ' Well, then, we'll fund you.'" Gardiner believes that therein lies the genius of DARPA. " DARPA funds questions." He says.

Dr. Gardiner searches through the trays of salamanders and locates the one he is looking for. This axolotl has an extra limb coming out the right side of its body. A second right front limb. " if we look at this extra limb on the salamander, we understand we humans have all the info to make an arm". To explain the concept of limb regeneration, Dr. Gardiner first provides a brief summary of mutagenesis, the process by which an organism's genetic information is changed, resulting in a mutation. "Mutations occur in nature, as the result of exposure to a mutagen," he says. "Natural mutations can be beneficial or harmful to an organism, and this drives evolution. Mutations can also be performed as experiments, in laboratories. DNA can be modified artificially, by chemical and biological agents, resulting in mutations." One consequential example of harmful mutagenesis that we discuss occurred as a result of ARPA's Project Agile defoliation campaign. People who were exposed to Agen Orange during the Vietnam War suffer a higher rate of children born with mutations. This include Vietnamese people who were sprayed with the herbicides and also a vigorously debated number of American service men who were involved in the spraying .

"Mutations tell us about signals," Gardiner explains, "Cells talk to each other using signals. Every cell has an identity. All cells have information. There are no dumb cells. Cells talk to each other to stimulate growth. They talk to each other to make new patterns." Pointing to the see through axolotl with the extra limb, Gardiner says, "People look at this salamander and say, ' salamanders are special. We (humans) will never regenerate like a salamander.'" Dr. Gardiner and Dr. Bryant do not agree. "We say, 'Oh really? How do you know?' The most compelling evidence is you have an arm." "Every human being on this planet regenerated his or her own cells, in the womb."

Golblatt chuckled. He'd left DARPA a decade ago, he said. He could discuss only unclassified programs. But he pointed me in a revelatory direction. This came up when we were discussing the Jason scientists and a report they published in 2008. In this report, titled "Human Performance," in a section called "Brain computer interface," the Jasons addressed noninvasive interfaces including DARPAs CT2WS and NIC programs. Using "electromagnetic signals to detect the combined activity of many millions of neurons and synapse" (in other words, the EEG cap) was effective in augmenting cognition, the Jasons noted, but the information gleaned was "noisy and degraded." The more invasive programs would produce far more specific results, they observed, particularly programs in which "a micro-electrode array is implanted into the cortex with connections to a 'feedthrough' pedestal on the skull." The Jasons scientists wrote that these chip-in-the-brain programs would be indeed substantially improve "the desired outcome," which could allow "predictable, high quality brain control to become a reality."

So there it was, hidden in plain sight. If DARPA could master "high quality brain control," the possibilities for man machine systems and brain computer interface would open wide. The wall would come down. The applications in hunter killer drone warfare would potentially be unbridled. The brain chip was the missing link.

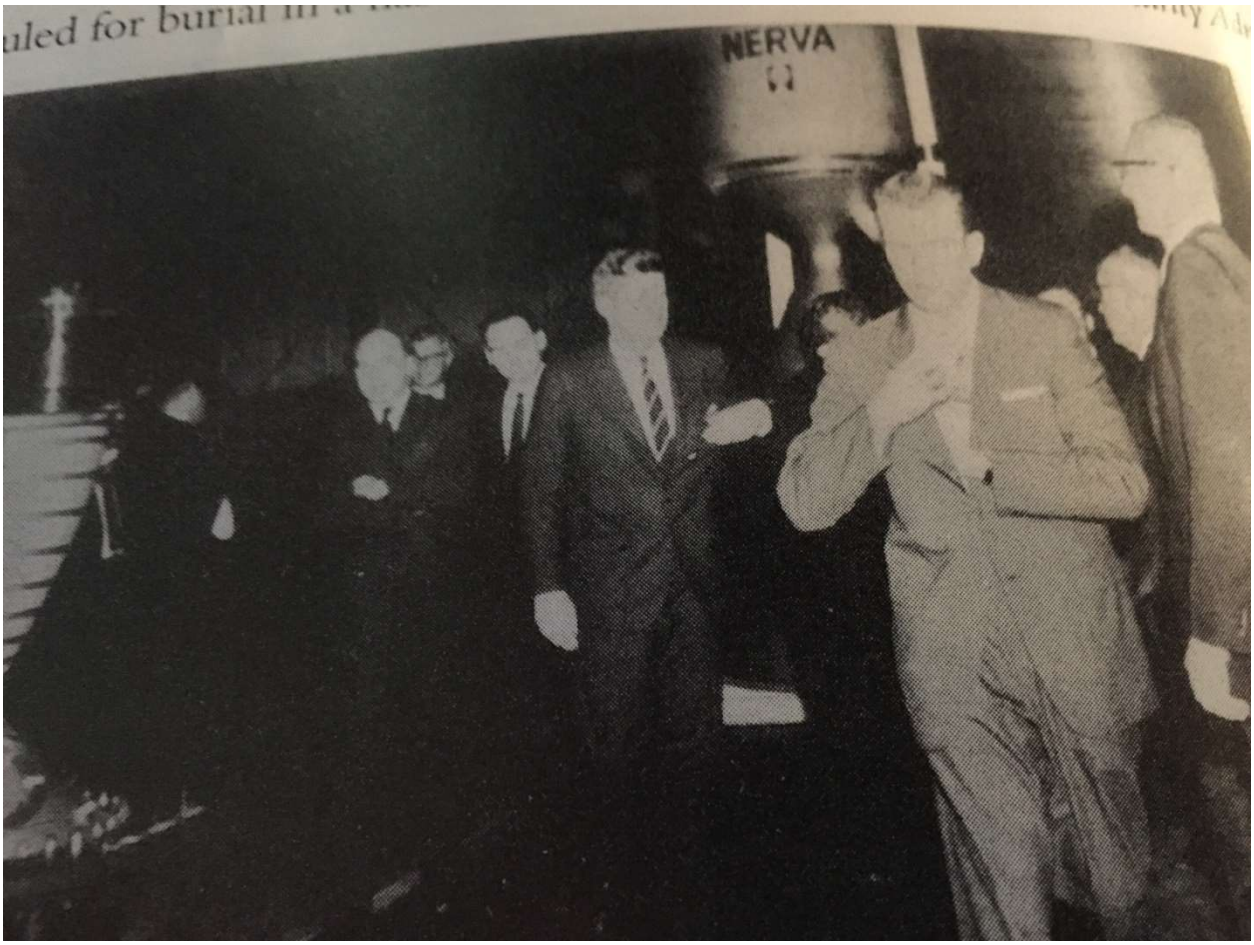
But even the jasons felt it was important to issue, along with this idea, a stern warning. "An adversary might use invasive interfaces in a military applications," they wrote. "an extreme example would be remote guidance or control of a human being." And for this reason, the Jason scientists cautioned the Pentagon not to pursue this area, at least not without a serious ethics debate. "the brain machine

interface excites the imagination in its potential (good and evil) application to modify human performance," but it also raise questions regarding "potential for abuses in carrying out such research," the Jasons wrote. In summary, the Jason scientists said that creating human cyborgs able to brain controlled was not something they would recommend. This warning echoed and earlier Jason warning, back during the Vietnam war, when secretary of defense Robert mcnamara asked the Jasons to consider using nuclear weapons against the Ho chi Minh trail. The Jasons studied the issue and concluded it was not something they would recommend. Using nuclear weapons in Vietnam would encourage the Vietcong to acquire nuclear weapons from their soviet and Chinese benefactors and to use them, the jasons warned. This would in turn encourage terrorists in the future to use nuclear weapons.

Can military technology be stopped? Should it be? DARPA's original autonomous robot designs were developed as part of DARPA's smart weapons program decades ago, in 1983. The program was called the "killer robots" and its motto offered prescient words: "The battlefield is no place for human beings".

To learn how to outfox radar, Lovick returned to the trial and error principles he'd first cultivated as a child. He set about designing and overseeing the building of Lockheed's first anechoic chamber to test scale models of Skunk Works' proposed new spy plane. "An anechoic chamber is an enclosed space covered in energy absorbing materials, the by product of which is noiselessness," Lovick explains. It is so quiet inside the chamber that if a person stands alone inside its four walls, he can hear the blood flowing inside his body, " Particularly loud is the blood in one's head," Lovick notes. Only in such a strictly controlled environment could the physicist and his team accurately test how a one-twentieth scale model would react to radar beams at it.

Krushcheve demanded an apology from his nemesis. Eisenhower wouldn't bow. Apologizing would only open Pandora's box. There was too many overflights to make them transparent. There had been at least 24 U-2 flights over Russia and hundreds more bomber overflights by General Lemay. Teo reveal the dangerous game of cat and mouse that had been going on in secret-at a time when thermonuclear weapons on both sides were ready to fly-would likely shock and frighten people more than having a president who lied. A national poll revealed that more than half of adult americans believed they were more likely to die in a thermonuclear war with the Russians than of old age. So Eisenhower made the decision to keep the focus on Gary Powers's flight only and admit that he personally had authorized. This was " the first time any nation had publicly admitted it was engaged in espionage," noted Eisenhower's lead U-2 phot interpreter at the time, Dino Brugioni.



Picture of President Kennedy touring the NERVA nuclear facility at Area 25. The plan was to build a nuclear powered rocket ship to take men to MARS in the astonishingly short time frame of 124 days.

After leaving Burbank, Collins and his fellow pilots were flown two by two, up over the Mojave Desert to the northeast, past Chine Lake, and into the Tikaboo valley. Flying into the restricted airspace above the Nevada Test site, Collins would look out the window and make a mental note of the ever growing landscape of giant craters. The appearance of a new, moonlike subsidence crater was often a weekly occurrence now that nuclear testing had moved underground. When seen from above, the landscape at the Nevada test site looked like a battlefield after the apocalypse. For Collins, the destruction was a solid visual reminder of what scorched earth would look like after a nuclear war. The agency couldn't have chosen a more dedicated pilot. Collecting intelligence on dangerous reconnaissance flights was Ken Collins's life mission; it was what he did best. He seemed to be propelled by a natural and kept alive by an unknown force Collins called fate. "Fate is a hunter," Collins believes. "When it comes for you, it comes," and for whatever reason it was not time for death to come to him yet. This was a notion Collins formulated during the Korean War while flying reconnaissance missions and watching so many talented and brave fellow pilots die. How else but by fate did he survive all 113 combat missions he had flown?

On those classified missions, the young Collins was armed with only a camera in the nose of his airplane as he flew deep into North Korea, sometimes all the way over the Yalu River, being fired at by MiG fighter jets. During the war, he was awarded a Distinguished Flying Cross and also the coveted Silver Star for valor, the third highest military decoration a member of the armed services can receive. Both medals were pinned on collins's chest before he turned 24.