

"Genghis John"

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By Franklin C. Spinney

One hardly expects the Commandant of the Marine Corps to agree with a dovish former Rhodes Scholar, or an up-from-the-ranks, brass-bashing retired Army colonel, or a pig farmer from Iowa who wants to cut the defense budget. Yet, within days of each other in mid-March 1997, all four men wrote amazingly similar testimonials to the intellect and moral character of John Boyd, a retired Air Force colonel, who died of cancer on 9 March at the age of 70.

General Charles Krulak, our nation's top Marine, called Boyd an architect of victory in the Persian Gulf War. General Krulak was "awed" by Boyd's intellect, character, integrity, and his selfless devotion to our nation's welfare. James Fallows, Editor of U.S. News and World Report, claimed that Boyd's "ideas about weapons, leadership, and the very purpose of national security changed the modern military." Retired Army Colonel David Hackworth, one of our nation's most decorated combat soldiers, wrote that Boyd's "legacy will be that integrity — doing the hard right over the easy wrong — is more important than all the stars, all the plush executive suites and all the bucks." And in a 20 March speech, Senator Charles Grassley (R-IA) declared that John Boyd, "the leader of the Military Reform Movement," was a man who "always set the example of excellence — both morally and professionally."

What kind of man could unite the emotions of such disparate men?

I met Colonel John Boyd in 1973, when I went to work for him in the Pentagon as a 27-year-old captain in the Air Force. He already was a legend, yet his most important work lay before him. Over the next 23 years, my life became intertwined with this maddening mix of eccentricity, intellect, creativity, and moral courage — a mix that did not fit into neat compartments. Over a career that spanned 50 years, he evolved from "40-Second Boyd," to the "Mad Major," to the "Ghetto Colonel," to "Genghis John."

Boyd opened his military career as a 19-year old draftee in the U.S. Army occupying Japan during the cold, wet winter of 1945-46. Morale was terrible. The soldiers froze in damp tents, often eating uncooked K-rations, while their officers indulged themselves with hot food in warm quarters. Boyd led the inevitable revolt — the mud soldiers chopped down a wooden hangar and burned it to keep warm. The Army, being the Army, court-martialed Boyd for destroying government property, but Boyd, being Boyd, converted the trial into a referendum on leadership and responsibility. The officers lost, the troops got hot chow, and the military got its first look at John Boyd.

40-Second Boyd

He left the Army and went to college on the G.I. Bill, where he met his wife, Mary, a woman best described as a saint. He graduated with a degree in economics, was commissioned in the Air Force, and became a fighter pilot. He flew about 20 combat missions in F-86s at the tail end of the Korean War — enough to warrant his selection as one of the first instructors at the fledgling Fighter Weapons School at Nellis Air Force Base in Nevada. He designed the dogfight tactics curriculum and earned the nickname "40-Second Boyd" as a result of a standing bet that he could maneuver from a position of disadvantage (challenger on his tail) to advantage (positions reversed) in 40 seconds — or pay the challenger 40 dollars. One of Boyd's lifelong friends, Ron Catton, a retired fighter pilot, and one of the few ever to graduate from the Fighter Weapons School with a perfect score, told me that Boyd usually needed only 20 seconds to win, but liked a little insurance in case something went wrong.

Boyd never lost. By the late 1950s, he was widely regarded as the finest fighter pilot in the Air Force.

He personified the romantic image of a fighter jock — tall, lanky, wildly gesticulating, loud, and irrepressible, an in-your-face type of guy, who smoked long thin stogies and blew smoke in your face, while he shouted and sprayed saliva at you in a head-on attack, from two inches, nose to nose. But 40-Second Boyd's flamboyant exterior hid an incisive mind, and he was about to blossom into a warrior-scientist — the "Mad Major."

The Mad Major

In the late 1950s, he began this improbable mutation by teaching himself enough calculus to work out the formulas describing his view of the maneuver-counter maneuver aerial duel. He published his results in a book-length technical report, the Aerial Attack Study, a secret document that eventually spread throughout the Free World and became the international bible of air combat.

His next stop was Georgia Tech in Atlanta. The Air Force sent him there to learn industrial engineering, a standardized curriculum that forced him to take a survey course in thermodynamics — the science of heat and energy. On the way to class one day, he had a flash of insight: the laws of thermodynamics, particularly those governing the conservation and dissipation of energy, were like the tactical give-and-take of an air-to-air duel. It was the kind of insight that characterized his genius for using analogies to combine seemingly unrelated pieces of information, gleaned serendipitously from very different disciplines, into a new world view.

As any logician will tell you, reasoning by analogy is a very dangerous game for most mortals. False similarities can capture our imagination, restrict our vision, and seduce us into seeing things that do not exist. To the orderly, Cartesian thinkers of the self-styled defense intelligentsia, Boyd had a very spooky way of thinking. To make matters worse, he had an IQ of only 90, which he claimed was an advantage because it forced him to be more efficient.

Nevertheless, Boyd always seemed to end up with the winning answer when the bureaucracy begrudgingly permitted the free market of ideas to work its painful magic. Most people attributed his success to luck, but he had a secret weapon: his uninhibited imagination was tightly coupled to a maniacal discipline to follow the truth wherever it might lead — even if it meant trashing his own creations. Boyd subjected each new synthetic analogy to rigorous analysis and testing, rolling it over and over in his mind, checking it obsessively for internal consistency as well as its matchup to reality, tearing it to pieces on paper, or during interminable phone calls at two in the morning, or, in the case of the analogy between thermodynamics and tactics — inside a computer.

Boyd hypothesized that a fighter's performance at any combination of altitude and airspeed could be expressed as the sum of its potential

and kinetic energies and its ability to change these energy states by maneuvering. With this idea as a point of departure, he thought he could describe how well a fighter could perform at any point in its flight envelope. If the hypothesis were true, the next step would be to compare the performance of different fighters and determine which one was superior to the other at each point in the envelope. Establishing such a global standard of comparison promised two enormous payoffs:

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First, he could compare the flying characteristics of an existing fighter to those of another, say an American F-4 to a Soviet MiG-17, and thereby identify what tactical regions of the flight envelope were most advantageous or dangerous to the friendly pilot.

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Second, he could evolve a design for a truly superior fighter by developing a comprehensive tradeoff process that systematically compared the performance of successive, marginally different designs.

While elegant in its simplicity, and computationally straightforward, Boyd's energy-maneuverability theory was a gargantuan number-cruncher that required millions of calculations. The only way to do these calculations was with a computer, but in the early 1960s computer calculations were slow, computer time was expensive — and Boyd had no budget. Furthermore, the aeronautical engineers were not interested in the inspiration of a dumb fighter pilot with a yukky industrial engineering degree. To make matters even worse, Boyd had no right to design airplanes — he worked at Eglin Air Force Base, Florida, where rednecks tested bombs designed by others, whereas the airplane designers worked at Wright-Patterson Air Force Base in Dayton Ohio, the home of the Wright brothers and the mecca for aeronautical engineering. For a man like Boyd, there was only one thing to do. He concocted a daring plan to steal thousands of hours of computer time by making it appear that the computer was being used for something else.

Much to the dismay of the autocrats at Wright-Pat, the Mad Major's theory of energy-maneuverability (E-M) turned out to be a stunning success. It provided a universal language for translating tactics into engineering specifications and vice versa and revolutionized the way we look at tactics and design fighter airplanes.

Boyd used it to explain why the modern F-4 Phantom performed so poorly when fighting obsolete MiG-17s in Vietnam and went on to devise new tactics for the Phantom — whereupon Air Force pilots began to shoot down more MiGs.

He used it to re-design the F-15, changing it from an 80,000-pound, swing-wing, sluggish behemoth, to a 40,000-pound fixed-wing, high-performance, maneuvering fighter. His crowning glory was his use of the theory to evolve the lightweight fighters that eventually became the YF-16 and YF-17 prototypes — and then to insist that the winner be chosen in the competitive market of a free-play flyoff.

The YF-16, which won, is still the most maneuverable fighter ever designed. The production successors, the not-so-lightweight F-16 (Air Force) and the F/A-18 (the Navy-Marine Corps aircraft that evolved from the YF-17), together with the F-15, dominate the skies today. Naturally, Boyd believed they could have been much better war machines if the bureaucrats had not corrupted their thoroughbred design with so many bells and whistles. Nevertheless, more than any other single person, the Mad Major is responsible for our nation's unsurpassed air superiority, which began in the mid-1970s and continues to this day.

Boyd received the accolades, if not the acceptance, of the aeronautical engineering aristocracy for his pioneering work, and the thanks of the combat pilots who now understood how to fight an F-4 against the more maneuverable MiGs.

The Air Force, being the Air Force, tried to court-martial Boyd for stealing the computer time but it could not come up with the evidence; in the end, investigators found only four hours of stolen time. When confronted, the Mad Major blew cigar smoke in the chief inspector's face and explained calmly how he had stolen the rest. He then showed the inspectors a thick file of letters, which documented how his

requests for computer time had been refused repeatedly by the bean counters at Eglin and the autocrats at Wright Patterson. He suggested they call Headquarters, Tactical Air Command, and tell the Commanding General that Boyd was about to be hosed for uncovering better combat tactics.

The inspectors, being inspectors, sensed a debacle and retreated. The bureaucracy, being a bureaucracy, said it had always liked Energy-Maneuverability and awarded Boyd a scientific achievement award and the Legion of Merit.

The Ghetto Colonel

All this was the stuff of legend in 1973 when I met Boyd, who was living modestly with Mary the Saint and their five children in a run-down apartment complex in Northern Virginia. He was well into his third mutation: the Ghetto Colonel. Like Immanuel Kant, he was an austere man of intense rectitude, whose life had become devoted to the study of science, philosophy, and the humanities in a small room. Like Kant, Boyd was obsessed with understanding how the mind creates knowledge, or in modern parlance, how it creates theoretical models of the real world — how new observations make existing theories obsolete, and how the mind replaces old theories with new theories in a never-ending cycle of destruction and creation.

To this end, he devoured books on physics, mathematics, logic, information theory, evolutionary biology, genetics, cognitive psychology, cultural anthropology, sociology, political science, economics. Between 1973 and 1976, he poured his intellectual energy into producing a 16-page double-spaced, type-written paper describing his theory. Entitled "Destruction and Creation," this abstract treatise describes how a dialectical interplay of analysis and synthesis destroys and creates our mental images of the external world. It describes what pressures drive this mental process, and how internal phenomena naturally regulate it in a never-ending dialectic cycle, which takes on the outward manifestations of disorder turning into order, and order turning into disorder.

At the heart of Boyd's theory of knowledge was a natural regulation mechanism that he discovered by unifying for the first time certain aspects of the Incompleteness Theorem of Mathematics and Logic discovered by Kurt Godel, an Austrian mathematician; physicist

Werner Heisenberg's Uncertainty Principle; and the Second Law of Thermodynamics. Typically, he did not even try to publish his paper, although he did vet it through many distinguished scientists and mathematicians — none of whom was able to poke any holes in it.

"Destruction and Creation" became the intellectual foundation of his monumental study of competition and conflict — although at the time, he had no idea where his philosophical musings might take him.

Looking back at those four years between 1973 and 1976, I now understand that they were a period of intellectual refueling for the next campaign in Boyd's war against a bureaucratic establishment that had lost sight of its goal. For unlike Immanuel Kant, Boyd worked in the Pentagon, a moral sewer dedicated to using other people's money to feed the predators in the Hobbsean jungle known as the military-industrial-congressional complex.

Viewed from this perspective, the Ghetto Colonel's lifestyle was much more than an aesthetic philosopher's quirk. It was a deliberate choice reflecting that bureaucratic warfare in the Hobbsean jungle had replaced the aerial dogfight as his first love.

Boyd loved a good skunk fight and he played for keeps — instinctively applying Napoleon's dictum of preparing a circumspect defense before unleashing an audacious attack. He built up his defenses by eschewing careerism and materialism, which left the generals and bureaucrats nothing to work on, no opportunity to gain leverage on him, no bait to tempt him into corruption. The Ghetto Colonel became an impenetrable fortress, a bastion of moral power in a way that Mohandas Gandhi would have easily understood. From the perspective of the bureaucracy's authoritarian mentality, however, the man was certifiably insane; even worse, he was completely out of control.

I once asked him why he lived this way. He got in my face, the ever-present cigarillo clenched between his teeth, its hot tip popping up and down a quarter of an inch from my nose, and amidst a gush of suffocating smoke, he explained: "The most important thing in life is to be free to do things. There are only two ways to insure that freedom — you can be rich or you can you reduce your needs to zero. I will never be rich, so I have chosen to crank down my desires. The bureaucracy cannot take anything from me, because there is nothing to take."

This statement went to the core of a puritanical ethos. For the Ghetto Colonel, life revolved around a simple choice: To be or to do? He could be somebody, with all the shallow accoutrements of power and small achievements — high rank, a big office in the Pentagon's E-ring, and a big post-retirement job with a defense contractor — or he could do important things and make a real contribution to society. The Ghetto Colonel was more interested in doing things than in being somebody, so he cranked down his needs. His choice really was very simple and logical, if somewhat bizarre and indecipherable to the inhabitants of Sodom on the Potomac.

I resigned from the Air Force in 1975. Boyd retired a few months later. He stopped smoking cigars, but not before accidentally burning a hole in a general's tie while using one as a pointer. By 1975, his work on Energy-Maneuverability, the F-15, and the Lightweight Fighters had made him the pre-eminent designer on new fighter concepts in America, if not the world. Most people with his kind of resume would have sold out to industry for a high six-figure income. The airplane contractors, in particular, wanted his talents desperately. One even offered me a fat job if I could convince Boyd to come with me. But the Ghetto Colonel had other things on his mind. His refueling operation was over, and he was ready for action. He was about to mutate into "Genghis John," the creator, chief strategist, and spiritual leader of the Military Reform Movement.

Genghis John

The transformation began quite modestly. After he retired, his old friend and partner in crime from the E-M days at Eglin, Thomas Christie, now a senior civilian in the Pentagon, arranged to hire Boyd as a consultant to the Program Analysis and Evaluation Directorate in the Office of the Secretary of Defense. Housed in a small cubicle of room 2C281, the infamous TacAir shop, Boyd worked 50-hour weeks, although he would accept payment for only one day per two-week pay period. He wanted to work for free, and the Ghetto-Colonel lifestyle enabled him to live on his retirement salary, but a minimal stipend was necessary to keep his security clearance current, and more important, to give him unfettered access to telephones and Xerox machines, which in the primitive days before e-mail were the weapons of choice among the small fraternity of reform guerrillas.

Operating out of this tiny cubicle, a man who held no official position used the force of his intellect and character to become, in the words of the Commandant of the Marine Corps, an architect of victory in the War with Iraq. The transformation of the Ghetto Colonel into Genghis John, however, had its origins in an unrelated anomaly.

The paradoxical results of the flyoff between the YF-16 and YF-17 continued to bother Boyd after he retired. The energy-maneuverability calculations predicted a much closer outcome, with the YF-17 theoretically superior in some portions of the flight envelope. But the pilots were unanimous — the F-16 won hands down. To a man of Boyd's mental discipline, test results in the real world had to be the final authority. So something was missing from his theory, but he did not know what.

He questioned the pilots closely, and with their help, he gradually determined that the decisive advantage of the YF-16 rested in flying characteristics like its "buttonhook" turn. When a YF-16 pilot pulled into an increasingly tight turn, the aircraft lost energy faster than did the YF-17. Normally, this would have been a disadvantage. Since the dawn of fighter aviation in 1914, power limitations made this kind of energy-dumping maneuver a desperation tactic. Once the energy was lost, it was difficult, if not impossible, to regain energy quickly enough to continue the dogfight if one was facing a competent adversary. But the high thrust-to-weight ratios of the new fighters changed the tactical nature of energy dumping in a very fundamental way.

The high-powered YF-16 could regain energy very quickly, and although the E-M calculations had led to the high thrust-to-weight designs of the lightweight fighters, the tactical effects of the added power were not fully appreciated during the design stage. During the flyoff, however, the pilots learned by trial and error to take advantage of this power by evolving quick energy-dumping as well as quick energy-pumping tactics. The energy-maneuverability theory could not predict the tactical advantages accruing from such fast-transient maneuvers, and it is a tribute to Boyd's iron discipline and integrity that he uncovered the limitations of the very theory that made him a world-renowned designer.

The discovery of the importance of fast-transient maneuvers, together with his research and writing of "Destruction and Creation" triggered the transformation of the Ghetto Colonel into Genghis John. Strangely,

the evolution began with a return to his roots and a new look at F-86 performance in the Korean War.

American fighter pilots achieved roughly a 10:1 kill ratio over their North Korean and Chinese adversaries. Nevertheless, it had long been recognized that the enemy's principal fighter, the MiG-15, could out-turn and out-climb the F-86 in most parts of the flight envelope. Why had American pilots done so well?

The conventional wisdom was that our advantage lay in better-trained pilots, a significant and undeniable fact. Boyd was the first to agree that people always are far more important than hardware in war. He often said "Machines don't fight wars, people do — and they use their minds." Nevertheless, his new appreciation of the tactical benefits of fast-transient maneuvers enabled him to understand how two technical advantages of the F-86 gave the pilot a powerful tactical advantage in a mind-time-space frame of reference.

The first related to visibility. The MiG-15 and F-86 were roughly the same size (the MiG was slightly smaller) and therefore about equally visible at a given distance with perhaps a slight edge going to the MiG. The pilot of the F-86, however, had a high-visibility bubble canopy and could see out of the F-86 much better than his counterpart in the MiG, whose head was confined by a more compact, aerodynamically streamlined canopy. So, in terms of one's ability to observe his adversary, the F-86 had a distinct advantage over the MiG.

In addition, the F-86 had a fully-powered hydraulic flight control system, whereas the MiG had a hydraulically-boosted mechanical system. An F-86 pilot could move the control stick with one finger, but the greater resistance of the control stick in the MiG meant that its pilot had to exert himself physically every time he turned. This difference in control power enabled the pilot of the F-86 to flip from maneuver to another more easily and quickly than his adversary. Moreover, this advantage grew more important as a dogfight continued, because the higher workload on the MiG pilot increased his mental and physical fatigue at an ever-increasing rate.

Putting these two advantages together, Boyd reasoned that a competent pilot in an F-86 could observe more effectively and decide and act more quickly than an equally competent pilot flying a MiG-15. Put simply, an F-86 that was losing the fight — with a MiG about 40

degrees of his tail — could start a turn in one direction, then, as the MiG followed, reverse the turn using the F-86's superior maneuverability. The maneuver might gain the F-86 pilot 10 degrees almost immediately, putting the MiG 50 degrees off. Repeating this maneuver-counter maneuver sequence — often called a scissors — would put the MiG pilot farther and farther out of sequence: relatively quickly, the F-86 pilot would be able to work himself into an advantageous firing position. Add in the decision-making effects of better-trained pilots, and our cumulative advantage in the observation-decision-action cycle permitted the F-86 pilot to operate inside his adversary's mind-time-space frame of reference.

Grasping another of his analogies, Boyd reasoned that the Germans had used their blitzkrieg to penetrate the French mind-time-space frame of reference in 1940. Perhaps his insight applied to ground warfare as well as air combat. Over the 15 years between 1977 and 1992, Boyd became obsessed with expanding his insight in to a general theory of competition and conflict. To this end, he absorbed the writings of great military theorists, like Sun Tzu, Clausewitz, and Jomini. He analyzed campaigns of the master practitioners, like Genghis Khan, Tamerlane, Belisarius, Frederick the Great, Napoleon, Grant, Manstein, T. E. Lawrence, Lettow-Vorbeck, Mao, and Giap. Beginning with the Peloponnesian War, he studied conventional battles and guerrilla warfare.

Boyd did not read books, he devoured them — marking them up, cross-correlating information in the front with information in the back, seeking out contradictions with every turn of the page, gleefully tearing each author's argument to pieces. After only six months, his copy of Clausewitz looked as if it were 100 years old. He never attempted to publish his work, but assembled all his research into a 13-hour briefing called a "Discourse on Winning and Losing." He gave the briefing to enlisted men and generals, congressmen, newspaper reporters, scientists, futurists, academics, anyone who would listen.

He thought that any conflict could be viewed as a duel wherein each adversary observes (O) his opponent's actions, orients (O) himself to the unfolding situation, decides (D) on the most appropriate response or counter-move, then acts (A). The competitor who moves through this OODA-loop cycle the fastest gains an inestimable advantage by disrupting his enemy's ability to respond effectively. He showed in excruciating detail how these cycles create continuous and unpredictable change, and argued that our tactics, strategy, and

supporting weapons' technologies should be based on the idea of shaping and adapting to this change — and doing so faster than one's adversary.

While the concept of disrupting an opponent's decision cycle is an old idea in military affairs, Boyd's theory of operating inside an adversary's decision cycle — or OODA loop — and its relationship to conflict is a bold new conception. His strategic aim was to isolate his adversary — physically, mentally, and morally — from his external environment by destroying his view of the world: his orientation. The key to appreciating the power of Boyd's idea is to understand why the orientation function is the door through which a competitor can penetrate his opponent's decision cycle.

Each of us bases our decisions and actions on observations of the outside world that are filtered through mental models that orient us to the opportunities and threats posed by these observations. As Konrad Lorenz and others have shown, these mental models, which the philosopher of science Thomas Kuhn called paradigms, shape and are shaped by the evolving relationship between the individual organism and its external environment.

In conflict, each participant, from the individual soldier trying to survive to the commander trying to shape strategy, must make decisions based on his orientation to reality — his appreciation of the external circumstances which he must act on. Boyd argued that one's orientation to the external world changes and evolves, because it is formed by a continuous interaction between his observations of unfolding external circumstances and his interior orientation processes that make sense of these circumstances. These interior processes take two forms: activity: analysis (understanding the observations in the context of pre-existing patterns of knowledge) and synthesis (creating new patterns of knowledge when existing patterns do not permit the understanding needed to cope with novel circumstances).

The synthetic side of the dialectic is crucially important to one's orientation, because it is the process by which the individual (or group) evolves a new world view, if and when one is needed to cope with novel circumstances. But as Kuhn and others have shown, the synthetic process can be extremely painful, because its nature is to build a new paradigm by destroying the existing one. Boyd strove to use multiple, quick-changing destructive thrusts to isolate his

adversary from reality by destroying his existing paradigm, and at the same time, deny his adversary the opportunity to synthesize a new paradigm. The combination of menacing pressure and an inability to cope with external circumstances cause the adversary to experience various combinations of uncertainty, doubt, confusion, self-deception, indecision, fear, panic, discouragement, and despair — which, in turn, overload his capacity to adapt or endure.

John Boyd is dead, but his ideas live on. They are cropping up in books, often without proper citation, in subjects ranging from warfare to economic competition to political strategy. Representative Newt Gingrich (R-GA) used them to plot the Republican takeover of Congress. Secretary of Defense Dick Cheney used Boyd's ideas when he overrode the Army's plan and insisted on the famous left hook into Kuwait. But the Marines have paid the retired Colonel the highest compliment. They will dedicate a section of their library at the Marine Corps University at Quantico, Virginia, to a collection of his unpublished papers and research materials.

His intellectual achievements pale beside the moral example he set. He asked for nothing other than the opportunity to contribute. I saw first hand how he passed up riches and status to make his contribution. He put service to truth and country ahead of everything else. He set an example of integrity and morality that is rare in a Washington where the Lincoln bedroom is for sale, the Speaker of the House flunks the ethics test, and the special interests of the defense contractors carry more weight than the needs of our soldiers and the rights of taxpayers — which is why men as different as General Charles Krulak, James Fallows, Colonel David Hackworth, and Senator Charles Grassley went out of their way to page homage to a great man's passing.

John Boyd always said the choice facing us all is "To Be or To Do." Paradoxically, Genghis John did things — and still ended up being somebody.

Colonel Boyd is survived by his wife, five children, two grandchildren, and — much to the chagrin of the card-carrying members of the military-industrial-congressional complex — a growing number of disciples who are carrying forward his good work.

Franklin Spinney, a former Air Force officer, has worked in the Office of the Secretary of

Defense since 1977. He worked closely with Colonel Boyd for more than 23 years.

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