Dradis

Part I

The early-warning/scanning system known as Dradis has a history quite typical of essential military hardware, but which also illustrates critical components of Colonial military practice and philosophy. Most importantly, the development of Dradis informs the turbulent period between the Cylon wars and also relates in two minor but illuminating ways to the Galactica crew.

During development and initial deployment, the word Dradis was an acronym or initialism: Direction, Range, Distance. In early documents it appears capitalized or initialized as DRADIS and DiRaDis. The first Dradis systems were radar alone, and the terminology stuck. Direction, Range, and Distance are still used in digesting Dradis information for reports and intel packages, such as AAR's and commendations, but all pilots understand that those terms are grossly simplified.

For 3000 years mariners have known that direction, range, and distance are not complete metrics for the dimensional complexity of space travel (and space warfare.) For the Dradis system which played such a central role in the first Cylon war, those metrics are just the shell or product of a system that is far more complex and innovative; the current Dradis is vastly more complex still. Later additional measurements and algorithms were used to track objects more accurately. Pitch, Roll, and Yaw were often confused with the planar geometry of shiphandling. The perfection of LEG (local effect gravitation) and GN (G-force neutral) systems further complicated the terminology by making "down" another course heading and "acceleration" and "rotation" relative. Mariners of course were comfortable with the spatial orientation questions, but the landsmen who designed the systems simply settled back on the word "Dradis" for the nameplate even though what was inside was much more than Direction, Distance, and Range. Current Dradis systems evaluate Carom, Deflection, Secondary Deflection, Sidereal Duration, Azimuth Quadrant Sine, Relative Rotation, Local Variable Ecliptic, and 116 other variables. The system also compensates for and reconciles signal diffraction, Doppler shift, several thousand types of intentional signal distortion, natural signal distortion, gravitational perturbation, and the occultation and diffraction of target signatures by objects ranging in size from suns to sandgrains.

The true innovation in Dradis is the evolution it underwent from an active to a passive receiver; that is, from a ping-return system to an extremely acute receiver of very subtle signals from the motion of objects through space, the firing of weapons, and the use of several dozen types of propulsion. Furthermore the development of the system offers a unique perspective on the Colonial—Caprican, really—military/industrial complex, and on that system's shortcomings and strengths. In short Dradis is a textbook on Colonial vulnerabilities and advantages.

Original Equipment: EM radars

Typical EM radars were used on spacegoing vessels in the Colonies for as long as ships traveled between planets. Close landing and coupling operations, space-atmospheric transitions, and land-bound telemetries still use various radars and other electromagnetic or radio refraction and reflection technologies. The term 'RDF' was typically applied, even though it is less precise in layman's terms even than the term 'radar.' In most Dradis-equipped vessels, EM radars contribute information to the Dradis logarithms and are central to fire-control, damage-control, and weapons evasion systems.

As early as the First Colonial Expansion, the limitations of pure radar became apparent. FTL accidents and other pre-mapping navigational worries made the radar's navigational value suspect. The original Colonial Stargoing Militia worked hard to improve radar as a detection device with little success—the limitations of electromagnetic radiation pulsing had been reached; ships were often traveling several times faster than the pulses that were supposed to measure and detect them.[1] As interplanetary travel became commonplace,

traffic control concerns also stressed the capacities of radar, and the solutions—increasingly large and powerful arrays and broad radiospectrum scanning, called RSF for Radiospectrum Flushing—took enormous amounts of computing power and maintenance to keep trade and travel flowing safely.

Meanwhile new innovations were brewing. Caprican corporations began experimenting with subatomic passive sensing, and in the early days of those explorations two critical minor events laid the basis for later complexity, confusion, conflict, and triumph.

Eliform Transplanetary Concern Ltd. began as an innovator in large-scale sonic forming of superlight materials for FTL vessels. Sonic forming had long been used in orbital manufacturing facilities, and the improvement of tolerances was geometric over the thirty years before the first Cylon war. The moving mind behind Eliform was Junal Pariteen, a Tauron. Pariteen invented major improvements in sonic generators, form patterns, and material preparation for the Taurian government's Research Corporation. In 3399, just six years before the Cylon War began, Pariteen 'emigrated' (suddenly, without papers, etc.) to Caprica. He began work immediately on several innovative projects despite being under Taurian warrants for hijacking technology. Colonial courts eventually settled the warrants in his favor, but the ill will persisted and the Taurians' declining fortunes in shipbuilding and technology are still blamed on Pariteen by many Taurians.[2] (Assertions that Pariteen was connected to the original Adama clan on Tauron have been refuted; the key figures were not contemporaries and their families lived on opposite sides of the planet. Tonder and Pegenall consider the Taurian commonality to be a coincidence.[3])

On Caprica, Pariteen joined other scientists and engineers and operated Eliform at a brisk profit.[4] In 3402 Eliform met a contract to form 29 forward bulkhead sections for what would be Battlestar Columbia, exceeding the deformation strength and shielding parameters by nearly 300%. Shortly after this success, the Fleet moved to acquire the company and merge it with their own research arm (which Eliform had humiliated numerous times). At one point the law firm of Arden and Evander was retained to defend Eliform in the ensuing lawsuit on a side issue; they prevailed.[5] At that time, Joseph Adama was a junior associate at Arden and Evander. Records indicate that Adama was peripherally involved in that action; his deeper involvement in the saga would come later.

The early overtures for a government merger were stalemated and delayed, but the outbreak of Cylon hostilities would lead to more forcible steps and Pariteen spent the rest of his career as a government scientist. But first he began tinkering with passive subnuclear emanation.

Leonidas Brinker had first identified full space subnuclear emanation in experiments in the 33rd century as part of a process to perfect FTL linking.[6] When the balancing energies were fully understood, the technology remained focused on drives and their predictive geometries. The unprecedented improvements in FTL speed and safety during that period—after four hundred years of stagnancy—seemed to the engineers to be success enough, and the potential of SNE's to improve other aspects of space travel went unexplored.

SNE's were always regarded as mysterious and unexplained by the physics of the day; given the tendencies of some of the colonies toward supernaturalism, it was inevitable that SNE's would become identified with spiritual forces. Several papers on SNE's as evidence of supernatural forces were published in the years after Brinker's studies, but they received no peer review and little attention beyond the usual sneering rejection by the science establishment.[7]

But one paper endured, and eventually became influential: an investigation into passive reception of SNE's by supplicants in prayer. The author, a Sagitarian named Benyamin Su Chevi, asserted that SNE's were heightened measurably during group prayer sessions in certain Sagitarian sects (including, not surprisingly, his own sect.).[8] He used sophisticated (for the time) Brinkerian receivers and claimed measurable modification of several species of SNE's during certain prayer rituals. No persuasive evidence that SNE's

could be altered had ever been published before. Since Su Chevi asserted (with little evidence) that the SNE's were created by prayer elsewhere, presumably by the Gods or by other civilizations (he proposed Earth), his conclusions were ridiculed and ignored except on Sagitaria. The paper languished.

In the late 3370's a Sagittarian skeptic and reformer named Marko Parri brought a Brinkerian receiver to a number of prayer services, intending to refute Su Chevi's claims as part of the attempted Sagitarian Secularization of 3377.[9] (Parri was unsuccessful and was one of the unlucky ones when the purges began; find a brief description of his painful story at ccc.SagSec/history/purges). Parri did indeed find nothing at the services…except for one. He repeatedly documented spikes and a variety of anomalies in SNE's at one particular temple, in the small town of Hubella, in Tyren. Over several months Parri frequented the place, and was in fact enrolled at the temple (though whether he was a convert, as he claimed at trial, or was just looking for access to the inner buildings, we will probably never know.) Parri made hundreds of precise measurements, and is credited with the first known documentation of control of SNE's.[10] He did factor out the act of prayer; the effects he observed occurred without regard to whether the temple was occupied. The only factor he could control seemed to be whether the large inner doors were closed.

We know now that the temple, with its ceremonial gong, golden steeple, copper sheathing, and bronze altars and statuary, was a crude SNE collector. The first modern Dradis was a rundown small-town church on Sagitaria.

Pariteen never explained how he came to understand the implications of the Parri/Su Chevi findings. A copy of the original Su Chevi paper and references to Parri were entered in discovery in several legal proceedings relating to Dradis technology over the past sixty years, but no direct references by Pariteen to those discoveries exist. It is certain that Pariteen visited the temple at least twice. Significant sums of money were donated in his name in 3380, and his notes contain detailed drawings and specifications of the temple layout. [11]

Early SNE evaluators seemed to be copies of the church. Four evaluators have been displayed at various times in museums on Caprica, and though the devices themselves were removed from public view after the start of the first Cylon war, existing photographs show an uncanny resemblance to the layout of the Hubella temple. SNE-receptive Dradis units deployed during the First Cylon war included an antenna assembly that resembled the obelisk-shaped Sagitarian steeple, and included a parabolic reflector (which often needed adjustment or replacement) that was still called "the gong" by technicians (though later manuals offered a bogus acronym for it—'geometric orthotic-neutral governor'.)[12]

Dradis technology was probably acquired by the Cylons during this period. Eliform worked closely with Grey Robotactics, the computing company that would later become Greystone. During the Cylon Investigation and Reconciliation hearings, Greystone executives confirmed that robotics involved in nearly every industry on Caprica, Tauron, and Aries—and, of course, the sonic forming processes in the Eliform plants in Caprican orbit and on Peole and Caripus—had far higher individuation and executive capacities than the Eliform contractors—or anybody else--understood. Greystone provided robotics to Eliform that stole Eliform's technologies. Of course, as we know now, Cylons were stealing Greystone technology, too.[13]

Cylon innovation skills were poor; their iterative engineering processes achieved substantial improvement of existing technologies but rarely invented anything new. Unfortunately, the potential for SNE evaluators was almost limitless at the point when the technology (probably) fell into Cylon hands, and so by the time of the second war Cylon Dradis far outstripped its Colonial counterpart. The Cylons were capable of evaluating radiation signatures of specific ships and had catalogued nearly every military vessel—including transports, fighters, even some individual drones—from a million kilometers away.[14] At the outbreak of war, Colonial Dradis was only capable of differentiating vessel types, and that poorly and inconsistently.

The evolution of the system from an active EM-radar style mechanism to a passive receptor is not well understood by historians, both because multiple story lines exist (more on this later), and because much of the information concerning the system is secret or proprietary or both. It is certain that now Dradis is a hybrid complex of SNE receptors and active radar pulsing. The most updated Dradis systems include multiple redundancies for reception, making jamming difficult. The systems also include SNE mimicry, which can create numerous tactical options for generating false telemetry and targeting formulations in battle, though such measures have not proven effective against Cylons, probably simply due to the paucity of ship-to-ship set-piece battles in which to employ them.

Another key piece of the technology puzzle of Dradis is the Intersystemic Dradis Mirror, (INDRAM). INDRAM permits smaller ships to interact with the main Dradis system on a B- or C-class base ship, and to extend and intensify the capacities of the system without any active communication between the ships (though there is a sublight lag, which causes deterioration at distance). Indram operates by adding SNE to the existing spectrum as an information carrying emanation. The Dradis systems on the subships absorb and analyze the SNE they receive and, by subtracting then rebroadcasting the emanations, convey information to the central system without creating a return or "ping" that can be read by an enemy. The measure is both stealth and communication simultaneously. Cylon subships lack this capacity, which makes them vulnerable to a variety of countermeasures and tends to counteract the normal Cylon advantage in numbers.

The development of Indram connects us to another chapter of Colonial history and another Galactica crewmember, Felix Idanti Gaeta.

Gaeta is Gemenese. Gemenon is an extremely conservative world with a tendency toward fundamentalism, like Sagitaron (though the two worlds, which are the nearest of any of the twelve, were often at odds and have fought 126 wars in 3000 years). Despite this limitation, science and technology are not suppressed on Gemenon as they were on Sagitaron; this is related in no small part to the Gemenese cultural valuation of identical twins. Because they valued twins so highly, the Gemenese could not discount the role of genetics in human conception and development. This generated a pragmatic acceptance of biology among even the most orthodox religionists there, though as we will see even that pragmatism had a limit.[15]

By law on Gemenon identical twins are separated, boys at birth and girls at one year. One of the twins (the "far twin") is exchanged with another identical twin of the opposite sex from another family, typically from as far away as possible. The exchange is arranged by a religious-governmental bureau that is among the largest agencies of the Gemenese government. The two separated twins are raised as siblings. In a few reformed families the practice is carried out but the children are told at an early age; but for most Gemenese—even secular people—the children are never told; only parents and other adults know. For this reason twin children are virtually never seen together; the sight of identical twins who are not adults is physically nauseating to many Gemenese. This despite the fact that the incidence of identical twins is nearly four times greater on Gemenon than on any other world. Fraternal twins are not considered twins on Gemenon; they are called "sims", short for "simultaneous siblings," and are considered a disappointment (unless their resemblance is close enough for them to pass as identicals.)

On Gemenon, adult twins are given preferential treatment. They are fast-tracked for appointment to bureaucratic posts and other positions of authority, which probably accounts for the famously awful Gemenese planetary, provincial, and local governmental efficiency. Large numbers of twins teach in Gemenese schools and colleges. Twins who live in close proximity to their siblings are indulged in petty violations of the law and minor institutional graft. It is customary for other Gemenese to yield their places in line to pairs of twins, or to anonymously pay for their meals in restaurants; it's considered good luck to do so. At most sporting events, theaters, and cinemas, twins enter on a single ticket.

[Gemenese routinely represent themselves as identical when they are not, which is a felony (only on Gemenon, of course), called diploid fraud. Given the parameters of Gemenese culture, twin status is clearly an advantage, and because twins are separated at birth, it is difficult to prove that a person is not a twin.]

It is often supposed that the twin-separation practice on Gemenon is intended to encourage the birth of more twins by keeping identical twin boys and girls in close proximity. How this conflicts with incest taboos has not been extensively studied. The "siblings" are formally reintroduced to their twin in an elaborate ceremony at about the age of 20. Many believe that, suddenly freed from any fear of incest taboos at that time, the "siblings" are more likely to marry and improve the odds of the birth of more twins. No scriptural or cultural proof of this purpose has ever been published. How this might affect non-twins who happen to have a sibling exactly a year older than they are is unclear. It is a common longing among children on Gemenon to find out that they are twins. 20-year-olds are generally jumpy at the prospect that any innocent outing or gathering might turn out to be their "reunification rite." The status value of twins is analogous to the status value of boys in other cultures, including on Libra, where the gender imbalance was a factor in the depopulation of the planet (along with a wildly erratic climate, massive earthquakes, and the least breathable atmosphere on the near worlds.)

Felix Idanti Gaeta was a beneficiary of this culture; he was an identical twin. Felix was the "home twin". his brother Artis Gaeta Pontic was exchanged and Felix acquired an older sister whose name became Beatrith Consan Gaeta. If the purpose of this tortured societal intrusion on family life was to produce more twins, Felix and Artis would disappoint; they were homosexual. Beatrith married a man—also an identical twin—she met at church, and presumably perished along with the rest of the planet, twins and all, in the Cylon attack.

Early, Gaeta showed great academic promise and was promoted through a series of educational competitions, typical on Gemenon. He chose evolutionary biology, and through a university program traveled extensively through the home worlds. Presumably this is where his interest in the Fleet developed, though he has never confirmed this. Though still devoted to the biological sciences, Gaeta created a number of innovative computer tools for cataloguing the evolutionary diversity of the planets; in the process he managed to anger religious authorities back home, evidently making a list of apostates and heretics maintained by the Bishops of the Gemenese church. How he first attracted attention is not known; the Gemenese do not share their religious records.

At 20 Artis and Felix met for the first time. Shortly after they both returned to the Kobol Colleges, which occupy the island of Jit in the single Gemenese ocean. The island, nearly continent-sized, contains 229 various universities, colleges, academies, seminaries, and research centers, comprising just over half of the higher education institutions in the Colonies. By a 3,000 year old decree, laws and requirements for religious and social conduct are relaxed on Jit in order to accommodate students from the other worlds and their tuition money.

In 3439, Gaeta convinced his brother to participate in a twin study on the nature of homosexuality. Because of the Gemenese habit of dividing twins, the colony provided an accidental experimental goldmine of evidence to consider the genetic basis of homosexuality (which has since been proven, and accepted throughout the colonies, except perhaps on Sagitaron.) Gaeta has said that he thought no more of the study after the single day of questionnaires and interviews.[16] Less than a year later one of his programs attracted the attention of a principal scientist at Eliform, by then called EFC for Eliformatics Corporation, the interwar entity that had a temporary reprieve from military service (in exchange for leaving Pariteen and other talent within the military research hierarchy.) Weary of the fieldwork and the slow pace of discovery in his field, Gaeta jumped at the chance to enter the private sector. In the process he came into contact with military officers, and was soon recruited for officer's training. He graduated first in his class and was commissioned in 3442 and immediately began working in conjunction with civilian scientists on Dradis. At least three of his upper-rank colleagues were aware of his homosexuality at that time. One of them was his

contemporary Lee Adama, who though not a close friend respected Gaeta's skill with technology. Circumstancial evidence will show that it is likely Lee who informed his father about Gaeta, because the elder Adama would in six months clearly demonstrate that he was aware and unconcerned that Gaeta was homosexual.

3442 was the main year of the political swing called the Core Realignment, which swept the inner Home Worlds. Scandal and oppressive taxation soured colonial voters. The entire federal machinery changed hands in the largest electoral shift in 900 years. Funding for the military was doubled; vast numbers of military personnel were recruited, and new officers like Gaeta found that as new ships came on line billets for officers were plentiful. Gaeta's rise was meteoric. The class of officers in which he found himself was at best mediocre, and he found it easy to distinguish himself. At that time he served a tour on Galactica as a weapons second, and distinguished himself in a minor incident that perhaps led to his continuous favor with Captain Adama.

While at Eliformatics, Gaeta had become integral to the ongoing process of refining Dradis. The system had been instrumental in achieving the stalemate and armistice in the first war, but the exigencies of warfare had not permitted any common retrofitting or refinement on the system infrastructure. When hostilities ceased, no two Colonial ships had the same Dradis system. Most were shaggy agglomerations of features with jacklegged code and piggybacked features that occupied the attentions of dozens of full-time techs. The captain of Theseus famously told one technician, who had asked permission to install yet another reception array on the outer hull, that he was tired of his ship looking like a junkyard. Once peace broke out, though, an expensive Dradis overhaul was not high on the Admiralty's list of projects.

So Gaeta took a tour on Galactica. While on a routine patrol in the Right Sector (so called because it stands at a right angle to the Prime Line, the natural route between Tauron and Caprica), Galactica began to have a series of Dradis malfunctions. Several researchers have argued persuasively that those malfunctions were Cylon-caused, not sabotage but the result of attempts by the Cylons to assess Colonial sensing capacities, but that has never been proven. In any event, in the confusion Galactica entered a standoff with a Caprican Militia vessel. The ships stood down before any shooting, but Adama stood to be humiliated by the errors and the comical image of a B-class warship nose-to-nose with a 900-year-old jalopy of a reserve local patrol vessel. Gaeta instead made a bold pitch to Fleet that the problems were Dradis related, and that the only solution was a fleet-wide overhaul and standardization of Dradis components. In the swirl of conversation Galactica's mistakes were overlooked, and the Dradis issues were resolved. If the original malfunctions were Cylon related, the overhaul might also have created a false sense of certainty among Cylon planners that the Colonial Dradis was weaker than it really was.

Shortly after that, though, the political situation became the key issue.

Six years in to the Core Realignment, most of the legislative initiatives brought about by the conservatives in the federal and world governments were foundering. Corruption and runaway spending put the lie to their fiscal caution, and the bills came home for the military buildup, causing tax issues and friction between worlds. Famines and health issues became pressing on several worlds, and the issue of the Libran depopulation heated tempers further. With little success in policies, political leaders turned to social issues to rally support and solidify power. All worlds except Caprica banned abortion and criminalized premarital sexual relations. Religious rituals were incorporated into governmental processes, and secularist parties and organizations were harassed. Speech and the press were censored and "decency" movements flourished. And a sharp anti-homosexual backlash began, predictably, on Sagitaron.

Felix Gaeta and the others who participated in the Jit studies had been promised confidentiality, of course, but the times changed, and a bombastic Sagitarian politician with federal ambition named Picu Renn acquired the paperwork for dozens of studies from the universities, which feared government interference or

funding cuts. Renn then cross-indexed the information in the studies with every database he could find, and mined propaganda gold.

Among the lists that Renn "held in his hand" was one with over 400 colonial officers who were homosexual. (Not on the list: women, especially up-and-coming connected Colonial women officers. Renn was possessed of many odd beliefs, including the notion that women could not be homosexual, so they were off the hook.) Renn's hearings were televised, of course, even after he was elected to the Senate and mentioned for the Quorum.

Gaeta realized that he was likely to appear on the list. Here the story becomes speculative, but accounts suggest that Gaeta confided in Lee Adama, who tendered Gaeta's offer to resign to his father. Instead, evidently, Adama contacted his own father, with whom he was not on easy speaking terms. But civil liberties were the elder Adama's bread and butter, and he set a trap for Renn using Felix Gaeta for bait.

On May 12, 3444, Renn called Gaeta as a hostile witness in a hearing to plumb the dangerous depths of homosexual "infiltration" in the Colonial fleet and marines. Gaeta was unavailable, but his attorney spoke for him, and by the end of the day the phrase "Have you no shame, sir?" had entered the Colonial vocabulary as classic retort to "social issues" fearmongering. Renn's career evaporated and the polity steered a gradual course toward moderation, and Felix Gaeta never again left Galactica.

To be continued

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