# DIAMONDS IN THE SKY: A SCENARIO IN THREE SCENES

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## PROLOGUE

This is a speculative scenario describing how nonnuclear weapons for strategic intercontinental warfare might be deliberately developed and introduced. Its purpose is to stimulate thinking about the possible forms and implications of nonnuclear strategic weapons, not to predict them. It is not based upon any facts or evidence, so far as they are known to the author. It is, however, intended to be both plausible and provocative. This scenario, in outline form, was first advanced by the author at a workshop on alternative nuclear futures, jointly sponsored by the California Seminar on International Security and Foreign Policy and the Institute on Global Conflict and Cooperation, at La Jolla, 8 and 9 January 1987.

## SCENE 1. LUCY'S DEBUT

The SS-17 launch was fully anticipated and the Aleutian radar picked up the second stage during its burn, even before it cleared the optical horizon. It was, after all, clearly a test bird, one that had been observed for more than a week on the development pad. Then the telemetry and range communications tests gave away the final launch preparations and window. It got off within four minutes of the U.S. analyst's prediction which had been based on the range voice traffic and not on the Soviet's formal notice required under the Space Protocols of 1992 signed last year.

The trajectory and burn were template-perfect, and the impact tracking radars were then brought on line to measure the reentry vehicle dispersions over Kamchatka. But after boost, everything began to change, first subtly, then increasingly until it was evident that both the post-boost and re-entry vehicles were brand new. In the cold early morning, the dozen or so American observers gathered around screens and bending over pen tracers saw the first evidence of what later came to be known in intelligence circles as "Lucy."

The first things drawing attention were the series of mid-course corrections--eight in all--each apparently stimulated by UHF transmissions from the post-boost vehicle toward the ground. (Later, a partial intercept of a transmission from the ground revealed that the post-boost vehicle transmissions were part of a series of two-way navigation communications with various ground stations.) The corrections were of differing magnitudes and directions, but seemed to increase past apogee.

More surprising to those watching the screens, none of the mid-course corrections was accompanied by the separation of re-entry vehicles or decoys. Initially, there was some concern that the Soviets might be testing "stealthy" RVs; but subsequent correlations of the telemetry signals and trajectory tracking showed that the mass of the post-boost vehicle had remained constant when corrected for expended steering propellants.

By the time the post-boost and re-entry vehicles finally separated, it was clear that the trajectory was slightly long for the SS-17 template into the Kamchatka impact range. But then the trace steepened and slowed sharply, and the American observers realized that they were watching a single, very low "beta" re-entry vehicle. One veteran observer remarked that it looked like the old Titan RV of thirty years ago as it "tucked under" and slowed down. To emphasize the uniqueness of what they were watching, he suggested to his companions that they might even see it go subsonic before impact.

Even as they were marveling at the re-entry trajectory, the vehicle began to break up: four large, but apparently light-weight objects separated from the main body and quickly fell behind in the RV's wake. Then the "sparklers" began. First two, then four, then eight, more, again and again, tiny specks spiraled away from the main body--like water droplets spreading from the arms of a whirling water sprinkler. There were hundreds, perhaps a thousand of these specks. It was clear, even from the evidence on the screens, that the RV was spinning on its wake axis, spewing these sparklers as it descended toward the horizon.

Then it was gone, lost to the curvature of the earth. What had they seen? Something unusual, no doubt about it. But what? What for? A first look at the telemetry added only a little to what they had all seen: The telemetry included what appeared to be the intervalometer circuits on board the RV--the circuits that had timed the release of the "sparklers". The release signals came in bursts--first at high frequency and in short bursts, but over time, with decreasing frequencies and in longer bursts.

Even before their shift ended, the American observers were convinced that they had seen some kind of dispensing payload for the SS-17. But they could only speculate on what the Soviets wanted to dispense. And why in that curious variable-burst spiral? The consensus that night was that they had witnessed the first test of a chemical agent dispenser for the SS-17. And that is pretty much where all speculation remained over the next several months.

## SCENE 2. DIAMONDS IN THE SKY

When the DIA analyst in Washington was given the assignment, there had been four more flights of the SS-17 with "sparklers". One of the flights had been a clear failure from the beginning: there were no mid-course navigational corrections and the whole kludge simply re-entered and broke up without ever uttering a word of telemetry. But the four good flights gave the analyst a solid basis for his evaluation and interpretation.

He quickly decided to concentrate on the sparkler patterns. The mid-course corrections were obviously navigational up-dates for a more precise orientation of the re-entry vehicle, and that made sense for accuracy. It was also clear that the re-entry vehicle was spinning on its longitudinal axis and the spin was being used to spread the sparklers. But the release of the sparklers in bursts was strange, deliberate, and slightly different on each flight. Thus, he concentrated first on the intervalometer signals off the telemetry recordings.

To recreate the sparkler patterns for his evaluation, the analyst resorted to a simple simulation on his PC: He aligned the axis of a spinning body orthogonally to the plane of his computer screen--as if he were following the re-entry vehicle in its wake. Then he programmed his simulated spinning body to release particles according to a spreadsheet schedule of intervals and frequencies taken from the telemetry. It took him a while to get the scales just right for the patterns to stay within the limits of his screen throughout the re-entry to impact.

His first attempt resulted in a pattern that looked like a spiral nebula. The twist in its two arms suggested that he hadn't the right spin rate. A check against the radar tapes gave him the spin rates he needed. When adjusted for the correct spin, the pattern resolved itself into a lop-sided diamond.

He then tried the same simulation with the intervalometer schedules for the other three flights. They produced lop-sided diamonds also, but of slightly different shapes. Some were long and thin; others were fatter and wider. But all had short sides that were about a third the length of their long sides. And the patterns of particles within the diamonds were perfectly regular--like soldiers in a marching formation. Except that these soldiers were actually spread out in time and space: they became neatly ordered ranks only from the perspective along the trajectory.

As the analyst printed copies of the patterns on the screen, he found himself wondering aloud:

"Diamonds. Why? Diamonds in the sky. Hellooo, Lucy! What are you up to with your diamonds in the sky?"

The unusual intervalometer signals now made sense: The bursts of sparklers emitted from the spinning re-entry vehicle--if properly timed and spaced--produced diamond shaped patterns orthogonal to the trajectory. But why diamonds? Why not circles or squares or rectangles?

Of course! The diamonds were *orthogonal* to the trajectory. The trajectory was steep, but it wasn't orthogonal to the ground. Even before he looked at the radar tapes, he knew what the answer was: Lucy's diamonds in the sky would produce rectangles on the ground.

When the trajectory impact angles were extrapolated from the radar tapes, the analyst was able to translate the diamonds down the trajectories and onto the ground. There were some positional uncertainties that distorted his patterns; but he found that they all resolved into perfect rectangles when he gave them an extra seven degrees of rotation over that which he had calculated.

What he now had was four rectangular patterns on the ground, each one oriented with its long axis at a different angle to the direction of its trajectory. The clincher came when he realized that the long sides of the four patterns were aligned on the ground at 0, 45, 90, and 135 degrees from the line of the trajectory. He was staring at the evidence of a very clever and deliberate attempt to lay down a systematic pattern of something on a rectangular target, no matter how that target might be oriented with respect to the trajectory.

What kind of target? How big were those rectangles on the ground? A few, relatively simple calculations gave the answer: The rectangles measured about 150 meters wide and 450 meters long. What kind of target was that size? How many sparklers were there in each rectangle? Their ranks appeared to be on eight-meter centers, but because their alignment within the rectangle varied from flight to flight, so did their numbers--from 1024 to 1082. What kind of target needed to be systematically carpeted with objects eight meters apart over an oblong the size of a city block?

The chemical agent theory didn't look right. Why were the Soviets being so methodical in the patternation? All the sparklers were eight meters apart on the ground; all of them fell within large rectangles of the same size and shape; only the orientation of the rectangles changed from flight to flight. The rectangles said something about the target; the sparkler patterns within the rectangles said something about the nature of the sparklers. The systematic pattern suggested that each sparkler had a limited and clearly defined radius of effect (5.6 meters by his calculation) and that the entire area within the rectangle had to be exposed to those effects. The effects of chemical agents wouldn't be so sharply subscribed--a cloud would suffice. Likewise with incendiary devices--a random pattern would do.

What kind of device would have such a clearly defined radius of effect? Something that was range-limited. Like a shot gun. A fragmentation grenade! That was it! Those neat rows could be fragmentation grenades, laid down to chew up everything in the rectangle.

But what city block was worth this extraordinary and systematic effort to shred it with grenade fragments? Troop formations? No, these had to be fixed targets for which the Soviets could program the intervalometers. Vehicles in their depots? Not armored vehicles--they wouldn't be hurt by fragmentation grenades--and trucks weren't worth it. Airplanes?

The analyst suddenly felt light-headed as he stood up, looking at the patterns on the screen, and imagined the typical aerial photograph of a military air base: Every air field he had ever seen had those parking aprons or hardstands, usually right in front of the maintenance hangers. That is where they kept all the airplanes that weren't being worked on or that weren't on alert.

He walked, trance-like, to the catalogs vault and began to scan the shelves, a part of him hoping that he couldn't find it. But there it was--right at eye level: *U.S. Military Facilities and Installations, Part IV--Air Bases, Air Fields, and Airports.* He noticed that his hand was trembling as he reached for it.

## SCENE 3. ENDANGERED SPECIES

At the end of the intel brief, the secretary indicated that he wanted to talk with the chief for a few minutes in his office. The chief and he had been good friends for more than 20 years, and he trusted the chief's judgment, particularly when the technologists and analysts seemed to be trying to stampede him in one direction or another.

The secretary wanted to know whether the chief thought this "Lucy" thing was as serious as intel seemed to be making it. Since intel was pointing the dagger straight at the Air Force, he thought the chief might deflect or mitigate intel's arguments. Somewhat to his surprise, the chief thought it was worse:

"They described the military problem this thing could pose in a hypothetical attack. That's serious enough. But I also have to worry about its impact upon the Air Force as an institution--not just in the unlikely event of war with the Soviets, but in peacetime, now, in our everyday bureaucratic battles over perceptions, for public support, and, yes, even next year's budget. This thing could have a devastating effect upon the Air Force, institutionally."

The secretary nodded solemnly, sensing the intensity of the Chief's concern. To draw him out, the secretary softly asked how he thought these effects would come about.

"With three or four dozen of these things, the Soviets will reduce the perceived life expectancy of every airplane we own to about 30 minutes into a conventional war. That's an exaggeration, of course, but not as much as you might think. The alert bombers and tankers could escape, but you know that they now account for only a fifth of the force. Some alert interceptors--mostly in Alaska and Florida--can get off, but they are an even smaller fraction of our fighter forces. The stuff in shelters overseas might fare better, but they already face an even stiffer conventional threat from Soviet fighter-bomber and missile strikes--that's why we paid the price for sheltering.

"The devastating loss I'm concerned about is the huge reserve of aircraft that we have always counted on in a conventional conflict--all of it based here in the States: the transports, all the C-5s and the 141s; all of the tactical aircraft we keep here as reserves and for training; all of the non-alert bombers and tankers that we have always intended to bring to bear in a conventional conflict, wherever it might occur.

"In an all-out nuclear war, we have never counted on much more than our alert aircraft surviving--they could do the job we ask of them. We would prefer more, and have plans to use them if we are lucky enough to have adequate strategic warning, but the point is that we never counted on them.

"However, in a conventional war, we have *always* counted on having all of our transport and tactical aircraft--and even some of our strategic bombers and tankers--all based here in the States, available

for mobilization and commitment. Now that prospect is dimmed, and in a couple of years it could be eclipsed. In a conventional conflict, the Soviets could sweep all those planes off the board."

The secretary said that these concerns sounded like wartime, not peacetime, concerns. The chief held up his hand, indicating that he was coming to that point:

"If the bulk of our planes--and I don't mean just a simple majority, but 70 to 80 percent of them--can't be guaranteed to survive for more than 30 minutes into a conventional war, then the Air Force is going to have one devil of a time convincing anyone that the investment in them is worth it. This Lucy thing threatens the sanctuary which we have always had for our airplanes when we based them far enough back to be immune to every threat except a nuclear attack upon our homeland.

"If the public generally perceives that airplanes anywhere can be destroyed in the first half hour of a conventional war, the Air Force, as the institution I have known, is severely threatened--in its mission, its budget slice, and perhaps most importantly, in our own perception of the decisiveness of air power. I don't have to tell you that, deep down, as an institution, we are about airplanes and flying, not about missiles, or even nuclear bombs for that matter.

"In my career, we have faced that kind of threat to the Air Force twice: The first time was in the sixties with the ballistic missiles. To meet that threat to our bombers, we had to draw them back to the States to gain more warning time, put more of them on alert, and beef up our warning systems--just to be sure that a fraction of them would survive for a retaliatory strike sufficient to deter the Soviets from trying it in the first place.

"The second time was in the seventies when the Soviets built up their fighter-bomber strength in Europe to the point that we weren't sure any of our airplanes there would survive the first half hour into a conventional war. We responded, as you know, with a very expensive sheltering program for our European bases.

"Both times, the responses were costly and the Air Force ultimately paid for it in fewer airplanes.

"Now the Soviets, in the nineties, are posing the half-hour threat to all of our airplanes, everywhere, and, this time, without nuclear weapons. And, you know, I think it is the transports they are after. They are telling us that we can forget rapid reinforcement of Europe even in a conventional conflict."

The secretary thought the chief was too gloomy. Surely the Air Force could find ways to counter such a threat, as it had in the past: Higher alert rates, aircraft dispersal, shelters?

"Of course we can and will. Some of the States-side fighters can be sheltered; but that is a very costly approach. So are higher alert rates; eventually you run into limits on the equipment and people to sustain those rates. But the transports were never designed to stand alerts, and sheltering them would be prohibitive: Can you imagine a shelter for a C-5? Over a hundred of them? We can disperse them, but I think the Soviets can beat us at that game by making more Lucies faster than we can pave hardstands to put airplanes on. We already know that dispersal drives up our base and maintenance costs very rapidly.

"What I'm driving at is that this Lucy thing is going to cost us dearly where we are already hurting. Airplanes, like the Navy's carriers, are getting more and more costly to protect and operate. And we are going to end up, as a result, with a lot less of them. And that has a very direct and adverse impact on the institution that I have devoted my life and heart to. Mark my words, even without a war with the Soviets, the Air Force will be badly hurt by this thing."

The secretary pursed his lips and nodded. But what about active defenses against this thing? Couldn't the SDI technologies be brought to bear?

"There is the one ray of hope that I can see. Even a defense that could handle only a few dozen ballistic missiles over the lower 48 could hold this thing at bay--that is, if it didn't rely on nuclear weapons. Even if the ballistic missile defenses could only keep pace with the Soviet deployments of these Lucy things..."

## EPILOGUE

As it turned out, the Chief's gloom was warranted. The Air Force did end up with fewer planes. And their hopes for defensive approaches were premature in both time and money.

Eventually, in the late nineties, the Air Force responded with a counter-threat: They developed two nonnuclear payloads for the Minuteman II which was about to be retired. One was comparable to Lucy and could threaten Soviet aircraft. But, since the Soviets were less dependent than the United States upon airplanes, that didn't quite even the score.

The second payload carried a brace of precision-guided shaped charges which the Air Force gleefully demonstrated could punch holes smack in the middle of silo doors on Kwajalein--three at a time.

And that is how the nonnuclear strategic arms race of the 21st century began.