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The *Vincennes* Incident: Another Player on the Stage?*

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On 3 July 1988 at 1024 local time, the Aegis cruiser, USS *Vincennes* (CG49), shot down Iran Air Flight 655 with two standard missiles. The civilian airliner was on a routine, international flight from Bandar Abbas, Iran, to Dubai, United Arab Emirates, flying on a designated commercial airway. The missiles intercepted the airliner at a range of eight nautical miles (NM) from the *Vincennes* at an altitude of 13,500ft. All 290 passengers and crew were killed.[1]

It has been over five years since this tragedy, but the *Vincennes* incident remains a contentious issue. Many questions have been raised and remain unanswered, and perhaps never will be fully answered given the complex nature of the event and the strong feelings it has evoked in all who were touched by its horrible consequences. Despite the continuing controversy that surrounds the case, we believe there is still the opportunity for learning. Thus we revisit the *Vincennes* incident not in the spirit of recrimination or fault-finding, but in the hope that it can teach us how to minimize the chances of a similar occurrence in the future.

We begin by summarizing the various inquiries, both official and unofficial, that have centered on the *Vincennes* incident. Limited by space and unable to do justice to all of the factors in this complex incident, we focus on one intriguing issue that has plagued all who have reviewed the case – the flight pattern of the Iranian airbus. Was it ascending or descending toward the *Vincennes*? We examine one possible explanation for the confusion over the flight path – the transposition of computer-assigned track numbers between Flight 655 and another aircraft in the operating area. Using the unclassified data from the formal investigation and report conducted by Rear Admiral Fogarty, we explore the extent to which the

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transposition of the track numbers could have been a factor in the downing of the Airbus. We conclude with some of the lessons to be learned in undertaking this exercise and recommendations for follow-on action.

VINCENNES INQUIRIES

The first investigation of the shootdown of Flight 655, directed by order of General George B. Crist, USMC, Commander-in-Chief, US Central Command, was conducted by Rear Admiral William M. Fogarty, USN, Director, JCS Policy and Plans (J-5) with a team of seven officers. A board of inquiry, convened in Bahrain by Rear Admiral Fogarty, sat from 13–19 July 1988. Drawing on all data collected from the interviews, testimony, on-site visits and analysis completed by experts at the Naval Sea Systems Command and at the Naval Surface Warfare Center at Dahlgren, Rear Admiral Fogarty issued his formal report on the findings to General Crist on 28 July 1988.

Additional inquiries and hearings followed this formal report. Under the direction of the Chief of Naval Operations, the senior investigating officer requested a USN medical corps team evaluation to determine if the dynamics on board ship were such that they impacted the crew's ability to perceive and relay data. The team, composed of psychiatrists and psychologists and led by Commander John Matecvun, were originally scheduled to spend up to 30 days, but in fact departed on 7 August 1988 after a three-day evaluation of the captain and the crew. The evaluation team sent a classified message off the ship detailing the crew's psychological health.[2]

On 8 September 1988, the Committee on Armed Services of the US Senate, chaired by Senator Sam Nunn (D-Georgia), heard testimony from witnesses, including Rear Admiral Fogarty and Rear Admiral Robert J. Kelly, USN, Vice Director for Operations, Joint Staff.[3] Additionally, the Defense Policy Panel of the House Armed Services Committee, chaired by Congressman Les Aspin (D-Wisconsin), called witnesses on 6 October 1988 to present testimony on the psychological factors that contributed to the downing of the Airbus. Five panelists representing the American Psychological Association (APA) gave testimony.[4]

Captain Will Rogers published his own exploration of the shootdown of Flight 655 in his book *Storm Center* in 1992.[5] His personal account as Commanding Officer of the USS *Vincennes* during the downing of the Airbus expanded and elaborated on the formal record presented in 1988. In addition, a Master's Thesis by Captain Kristen Ann Dotterway (USAF), completed at the Naval Postgraduate School, relied on his co-operation to explore some of the unanswered questions arising from the 1988 formal report.[6]

Another inquiry of the *Vincennes* incident was spearheaded by *Newsweek* correspondent John Barry and retired Marine Lieutenant Colonel Roger Charles in collaboration with "Nightline", an ABC sponsored program. Their report, entitled "Sea of Lies"[7] and detailed in a *Newsweek* article on 13 July 1992[8] provided an alternative perspective on the shootdown and its causes. And finally, Lieutenant Colonel David Evans (US Marine Corps Retd), published his evaluation of the

Vincennes incident in a "case study" published in the US Naval Institute *Proceedings*, in August 1993.[9] Building on information from Captain David Carlson, then commander of the frigate USS *Sides*,[10] this also questioned the government's and Captain Rogers's explanations on the downing of the Airbus.

DESCENT OR ASCENT OF FLIGHT OF 655?

Discrepancies about the events surrounding the *Vincennes* incident range from the major to the minor. Of particular significance is the trajectory of Flight 655. While the Aegis data tapes revealed a flight pattern of ascent from a take-off in Bandar Abbas,[11] crewmen in the *Vincennes*'s Combat and Information Center (CIC) recollected a pattern of descent toward the *Vincennes*, a pattern more characteristic of an attack profile. While it is acknowledged that this discrepancy was not the sole causal factor in the shootdown in both the Fogarty Report and Captain Rogers's book *Storm Center*, it raises some important questions about the CIC operators' ability to perceive and interpret data and the commanding officer's ability to make informed decisions from those data. This is an especially important issue under periods of "time compression" when decisions have to be made, as in this case, in a very short period of time – three minutes and 40 seconds to be exact.

Unable to account for the discrepancy between system data and the crew's recollections of the Airbus's flight pattern, Admiral C.A.H. Trost, Chief of Naval Operations, directed a team of medical experts to conduct an evaluation of the crew. Crediting their conclusions, the Fogarty report states that "stress, task fixation, and an unconscious distortion of data may have played a major role in this incident".[12] Continuing, the report states that "in an unconscious attempt to make available evidence fit a preconceived scenario, (considered by psychologists to be "scenario fulfillment"), the tactical information co-ordinator (TIC) appears to have distorted data flow".[13]

When the team arrived on board his ship, Captain Rogers asked them "how five people at five separate consoles could have seen something that hard data did not support?" He quotes their response in *Storm Center* p. 161:

> The question of perceptual distortion or misinterpretation of data in relation to combat stress was examined. It is well known that an expectant mind-set can lead to misinterpretation of data. . . . Chances of occurrence can be related to combat stress and perceived threat, but other factors such as experience, uniqueness of data, lack of confidence in equipment or leadership and length of time to evaluate data must be considered pertinent. That five or more combatants, some with prior combat experience, most with extensive equipment experience, all viewing separate displays for cognitively separate periods of time would have the same perceptual distortion or misinterpretation of data is highly implausible.

Having verified in a personal communication with Commander Matecvun[14] the accuracy of the Rogers's account, we are left with another puzzle. If "perceptual distortion or misinterpretation of data is highly implausible", what then can account for the discrepancy between the system data and the crew's recollections? Again, we turn to Captain Rogers's commentary for some clues.

On 10 July 1988, Senior Chief Tim Cox, Chief Mike Adams and a team of computer technicians from the *Vincennes* conducted their own informal analysis of the system print-outs. They knew, for identification purposes, every unit working in the link was assigned a participating unit (PU) number so that each input from that ship or aircraft could be identified. They discovered that the *Vincennes*'s original track number 4474 for the Iranian Airbus shifted to 4131 – a track number that came from the USS *Sides*. The shift was not an uncommon occurrence. It was an automatic feature, allowing Aegis to "conserve" assigned track numbers. Due to the Aegis system's enormous targeting capability, another unit's track number would be automatically adopted if the system made a track correlation with its "own ship" information.

In examining the system data, they identified a peculiar trend: when track number 4474 was dropped, it did not remain in storage as an unused track number but kept reappearing throughout the air engagement.[15] Chief Cox reported this perplexing data to Rogers:

> The weird thing we can't figure is that 4474 was deleted as an active number and taken back by us, but it didn't go away, it keeps reappearing over and over and dropping in and out. We can't tell for sure because we don't have everything we need, but it looks like another PU was in the link using our track number assignment.[16]

Captain Rogers immediately approved Chief Cox's request to work with the analysts from NSWC Dahlgren to research the source of this "anomaly". After co-ordinating with the analysts, led by Mr. Reuben Pitts, Chief Cox reported the findings to both Captain Rogers and his legal counsel, Captain Dennis McCoy, USN:

> Okay, let's start simple. As you know, each PU is assigned a block of numbers for its use. Once this authorized track block is entered into the unit's combat system, contacts reported by the unit are automatically assigned track numbers from that block.
> Okay, on 3 July we were assigned the block 4400 to 4576, and we were link manager. The *Sides* was assigned 3400 to 3576 but for some reason was reporting contacts using 4100 series numbers ... Anyway the USS *Spruance* was operating about 180 miles south-east of us in the Arabian Sea and reported a contact using TN 4474, the same number we originally assigned to the Airbus. They pegged this to a low flying A-6 from the *Forrestal* and apparently they didn't update and let it coast ...
> Now, get this: HMS *Manchester*, which was entering the southern link with us, picked up the *Spruance* contact, updated it, and reported it over the link. They entered this track at almost the same time the Airbus was about twenty miles from us.[17]

Captain Rogers reflected on Chief Cox's remarks and recalled the following sequence of events at the 20NM critical decision point in which the *Vincennes* was entering into the air-to-surface weapon's envelope:

> I recalled that when the unidentified aircraft was at about that range, I had asked, "What is 4474 doing?" I was unaware at that moment that the *Sides*'s TN 4131 had been adopted automatically by the system (to identify the Airbus) and 4474 retrieved by the *Vincennes*. The answer I'd received over the interna

communications net was "descending altitude, speed 450 knots". We now apparently know that the information referred not to the Airbus but to the A-6 Intruder.[18]

We found no reference in the Fogarty Report concerning the possibility of a track number transposition between two aircraft. Instead, Admiral Fogarty's later testimony at the Senate hearing reaffirmed what he still considered to be a puzzling aspect of the incident – the "misreading of altitude". He stated his investigation team was "unsuccessful in satisfactorily reconciling the conclusion that the contact was descending when in fact the Aegis weapon system showed the aircraft always to be climbing".[19] However, he did believe that "with little time and under combat stress during a surface engagement, watchstanders misinterpreted some tactical information".[20]

Picking up on the theme of combat stress and scenario fulfillment, five psychologists on behalf of the American Psychological Association testified before Congress on the *Vincennes* incident. Based on their reading of the Fogarty Report and its subsequent endorsements by General Crist, Admiral William J. Crowe, Jr., Chairman of the Joint Chiefs of Staff, and Mr. Frank C. Carlucci, Secretary of Defense, and without benefit of personal dialogue with the crew, also concluded that there were "predictable failings of human judgement under intense stress compounded by complex technology [which] clearly contributed to the accidental shooting of Iranian airliner Flight 655".[21] Their testimony and the growing congressional interest and scrutiny surrounding the issue prompted the Office of Naval Research to launch a major research initiative called Tactical Decision-Making Under Stress (TADMUS) in order to learn how to avoid similar occurrences in the future.

Given the widespread belief that combat stress was responsible for the crew's "misreading of altitude", there has been little effort to explore alternative explanations. In fact, Captain Rogers's "discourse" on track number 4474 is considered "mysterious" by some.[22] Yet Captain Rogers continues to maintain that a second aircraft existed and that its track number was transposed with that of the Iranian Airbus. Specifically, he attributes the transposition of the numbers not to the Aegis system nor the console operators, but to the Navy's Tactical Data System Link 11 network and the way shipboard systems assign track numbers to a contact.[23]

We are not in a position to judge the efficacy of the Tactical Data System Link 11 network nor do we have access to the geographic track files of the vessels and air contacts involved. Instead, we seek to test Captain Rogers's explanation of the discrepancy between the system data and the crew's recollections of the events by matching it against the data available in the Fogarty Report. Is there evidence to support Captain Rogers's contention?

ANALYSIS

The first step in our analysis was to create a "data base" from the Fogarty Report. It consists of two kinds of data: the *system data* derived from the system tapes and the *recollected data* drawn from interviews with the crew after the incident.

Table 1 summarizes the system data in the Fogarty Report extracted from the data tapes of the Aegis Command and Decision (C&D) system. The data are presented in the form of range, altitude, time, speed and track number variables. For example, at a range of 44 NM, an aircraft, assigned the track number 4474, was flying at an altitude of 2500ft at a speed of 232 knots at 10:18am, local time

The recollected data, from witnesses' statements and testimony, are summarized in Table 2. Since no internal voice recordings are available, these data, of necessity, rely on individuals' perceptions and recall. For example, the AIC-3 remembered a plane, track number 4131, flying at a range of 30 NM, at an altitude of 9,000ft, at 10:21am. Thus, the information in Tables 1 and 2 are a tabular composite of data entries extracted from the text in the air engagement "Time Line" section of the Fogarty Report.[24]

Combining the data in Tables 1 and 2, we see in Table 3 the variance between the system data and the recollected data. Some recollected data entries are reasonably close to actual data entries – within 2,000ft in altitude and within three nautical miles. These are marked with a "0". Others, marked with a "[•]", show greater divergence from actual data entries – in excess of 2,000ft and three and nautical miles. Thus, the first entry for AIC-3 is coded as "0", indicating a disparity of only 2,000 feet in altitude and a disparity of only one nautical mile between the system data and the AIC-3's recollections. On the other hand, the third AIC-3 entry, indicated "[•]", reveals a disparity of 3,300 feet in altitude between the system data and the recollected data.

Table 1

System data with range, altitude, time, speed and track number variables

Range	*Altitude*	*Time*	*Speed*	*Tn*
47	900[a]	1017	—	4474
44	2500	1018	232	4474[b]
40	4000	1019	303	4131
34	6160	1020	334	4131
29	7000	1021	350	4131
25	8400	1022	—	4131
22	9200	1022	—	4131
20	10000	1022	360	4131
110	11900	1022	448	4474[c]
16	11230	1023	371	4131
15	11000	1023	—	4131
14	12000	1023	382	4131
12	12370	1024	380	4131
10	12950	1024	385	4131
8	13500	1024	383	4131

a. Altitude obtained from Senate Hearing, 1988, p. 10.
b. Aegis auto-correlated the *Vincennes*' track number of 4474 and the *Sides*' track number of 4131, resulting in TN 4131 as the new track number for the air contact originating from Bandar Abbas.
c. FC-1 hooked TN 4474.

Table 2
Recollected data by witnesses with range, altitude, time, speed and track number variables

Who	*Range*	*Altitude*	*Time*	*Speed*	*Tn*
GW	$ 39	9800	1020	—	4131
AIC-3	30	9000	1021	—	4131
AAWC	30	$ 8500	1021	—	——
OSDA	29	8000	1021	—	4131
49 ADT	25	12000	1022	—	4131
CSC	22	10300	1022	—	4131
IAD	20	10500	1022	—	4131
AIC-3	20	9000	1022	—	——
TIC	15	11000	1023	—	——
AIC-3	15	7700	1023	—	4131
IAD	$ 15	7800	1023	450	——
RSC	12	$ 5500	1024	—	——
IDS	$ 11	7800	1024	445	4131
49 ADT	10	7800	1024	—	4131
TIC	10	10000	1024	—	4131
AAWC	% 8	$ 6500	1024	—	——
MSS	6	7000	1024	—	——
UBS	6	7000	1024	—	——

$ Several witness accounts were provided in the form of ranges. These ranges were averaged to obtain a single value in order to plot the data point.
% "At engagement" estimated by the authors to mean 8NM.

Table 3
Variance table between system and recollected data

CIC member	*S range* / *R range*	*S altitude* / *R altitude*	*S time* / *R time*	*Disparity in range*	*Disparity in altitude*
† GW	40/39	4000/9800	1019/1020	1 NM	5800 ft
* AIC-3	29/30	7000/9000	1021/1021	1 NM	2000 ft
* AAWC	29/30	7000/8500	1021/1021	1 NM	1500 ft
* OSDA	29/29	7000/8000	1021/1021	0 NM	1000 ft
• 49 ADT	25/25	8400/12000	1022/1022	0 NM	3600 ft
* CSC	22/22	9200/10300	1022/1022	0 NM	1100 ft
* IAD	20/20	10000/10500	1022/1022	0 NM	500 ft
* AIC-3	20/20	10000/9000	1022/1022	0 NM	1000 ft
* TIC	15/15	11000/11000	1023/1023	0 NM	0 ft
• AIC-3	15/15	11000/7700	1023/1023	0 NM	3300 ft
• IAD	15/15	11000/7800	1023/1023	0 NM	3200 ft
• RSC	12/12	12370/5500	1024/1024	0 NM	6870 ft
• IDS	12/11	12370/7800	1024/1024	1 NM	4570 ft
• 49 ADT	10/10	12950/7800	1024/1024	0 NM	5150 ft
† TIC	10/10	12950/10000	1024/1024	0 NM	2950 ft
• AAWC	8/8	13500/6500	1024/1024	0 NM	7000 ft
• MSS	8/6	13500/7000	1024/1024	2 NM	6500 ft
• UBS	8/6	13500/7000	1024/1024	2 NM	6500 ft

† Data entries that appeared incompatible with both recollected and system data
* Recollected data entries that were reasonably close to system data entries – within 3 NM and 2000 feet
• Highly disparate entries from system data entries – in excess of 3 NM and 2000 feet
"S" System data entries from Aegis data tapes
"R" Recollected data entries by witnesses

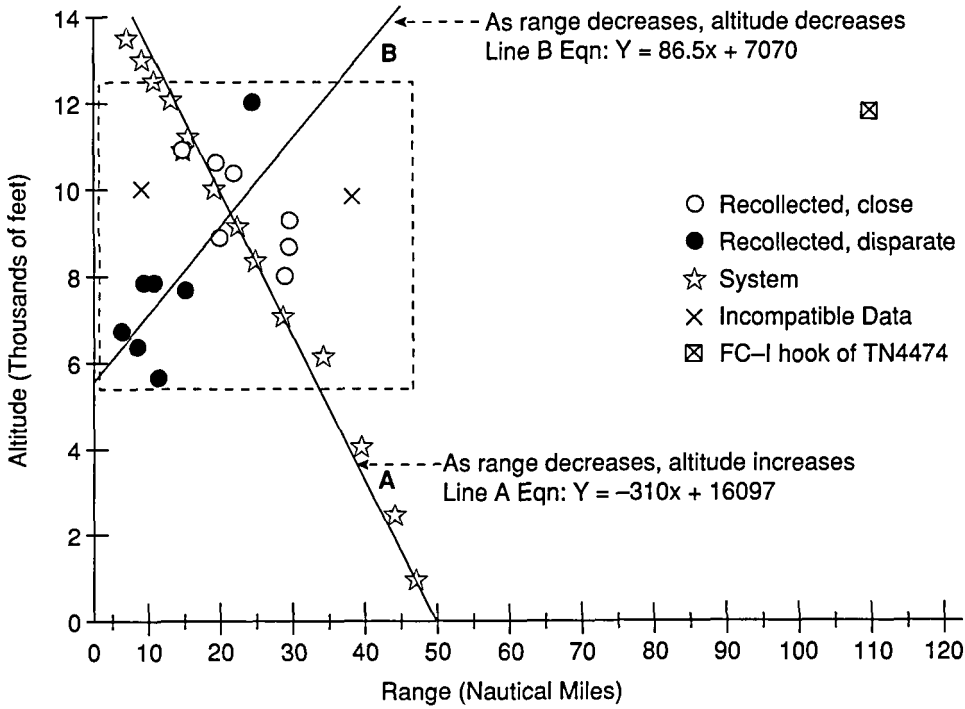

Figure 1 System & Recollected Data Combined – Altitude vs. Range

In order to compare visually the relationships between the system data and the recollected data, we created scatter plots in Figures 1–4. Figure 1 combines both system and recollected data and plots altitude against range. Figure 2 combines system and recollected data and plots altitude against time. Figure 3 shows the recollected data points and plots altitude against range, and Figure 4 combines both system and recollected data and plots speed against time.

We see in Figures 1 and 2 some interesting patterns. First, when plotted against range and time, the system data (indicated by a "star") show Flight 655 to be continuously climbing in altitude, revealing a strong linear relationship among the system data points. We also see that the system data point representing the FC-1's hook of TN4474 (indicated by an "X" in a box and best seen in Figure 1) is not part of this linear relationship. In fact, as an outlier among the system data points, separated by a minimum of 60 NM, it suggests the existence of a second aircraft. Yet its track number – 4474 – is the same track number that was originally assigned by the *Vincennes* to Flight 655 when it took off from Bandar Abbas.

Examining the recollected data in Figure 1, we see a weak clustering tendency. Some of the recollected data points (those indicated by "0") cluster around the "line" of the system data. Other recollected data points (indicated by a "[0]") cluster together in the lower left-hand quadrant of the graph. Thus, while some

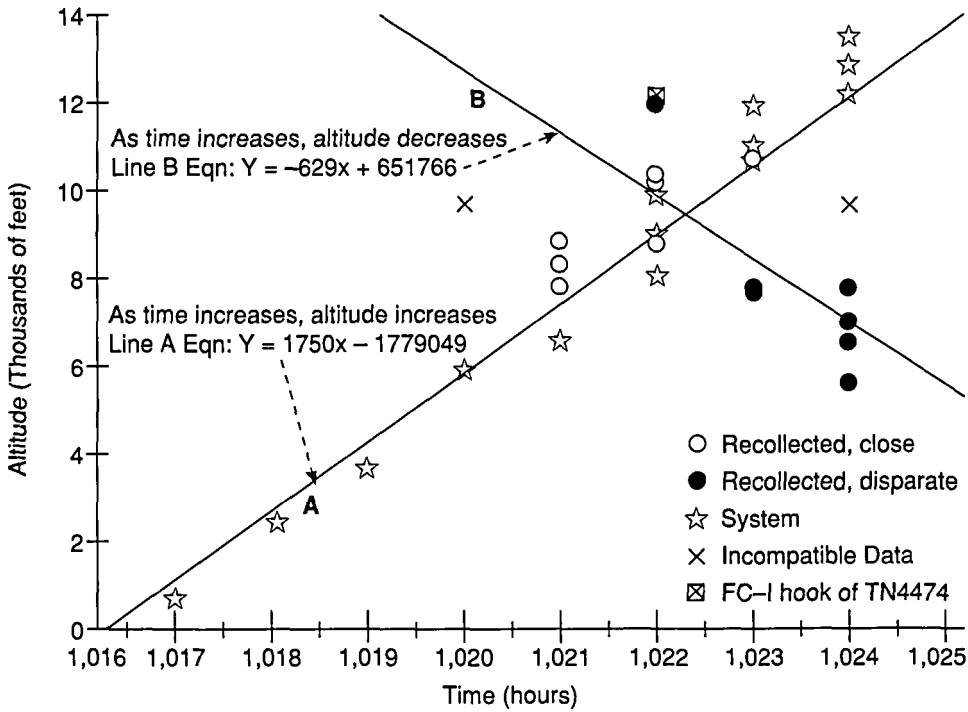

Figure 2 System & Recollected Data Combined – Altitude vs. Time

data points suggest the contact is increasing in altitude, others suggest that it is decreasing in altitude. This clustering pattern is also consistent with the existence of two aircraft.

To investigate further the clustering pattern of the recollected data, we plotted the recollected data by individual witnesses in Figure 3. In a magnification of the box drawn in Figure 1, Figure 3 labels the recollected data points by each witness who provided the particular kinematic data point. Thus, we see that six CIC watchstanders matched the system data entries compatible with a climbing profile: A1C-3, AAWC, OSDA, CSC, IAD, and TIC. Conversely, eight CIC

LIST OF ACRONYMS

AAWC	Anti-Air Warfare Co-ordinator	MSS	Missile System Supervisor
ADT	Automatic Detection and Tracking	NTDS	Naval Tactical Data System
AIC	Air Intercept Controller	OSDA	Own Ship Display System
CIC	Combat Information Center	PU	Participating Unit
CSC	Combat System Controller	RSC	Radar System Controller
FC	Force Co-ordinator	SUCAP	Surface Combat Air Patrol
IAD	International Air Distress	TIC	Tactical Information Co-ordinator
IDS	Identification Supervisor	TN	Track Number

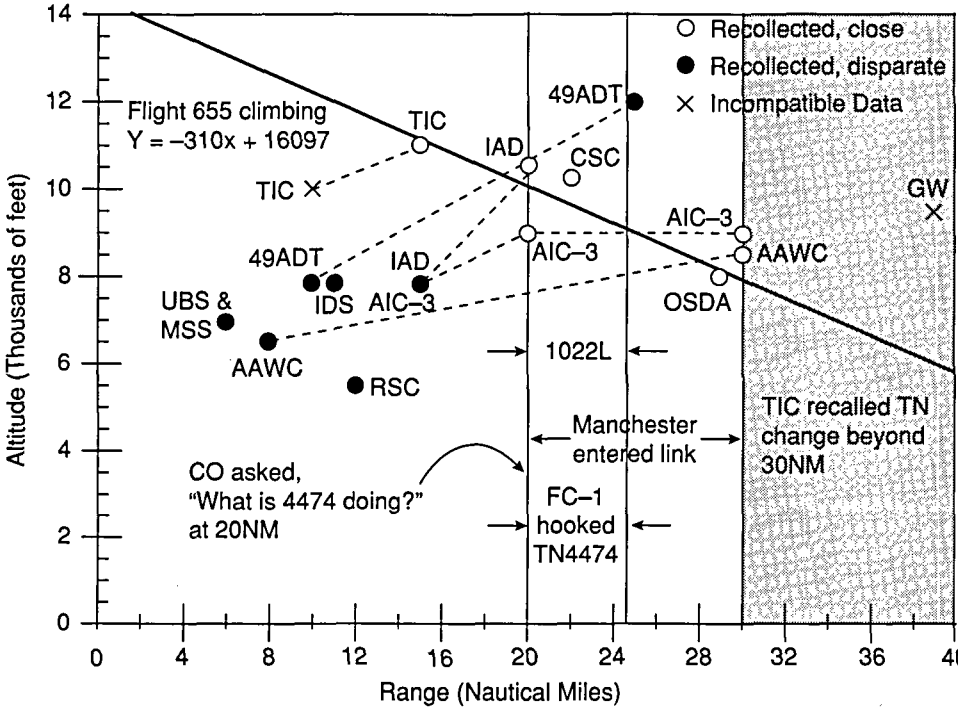

Figure 3 Recollected Data by Witnesses – Altitude vs. Range Scatter Plot

watchstander data entries progressively diverged from the system data and saw a profile compatible with descent: IAD, AIC-3, AAWC, RSC, MSS, UBS, 49ADT, and IDS. Of these witnesses, five of the eight crew members had double or triple recollected data entries. As shown by the broken lines in Figure 3, these crew members observed decreases in altitude from their previous observations made a minute or two earlier. Even the TIC, whose observation matched exactly with the system data at 11,000ft, saw a 1,000ft decrease in altitude a minute later, while the 49 ADT saw a 4,200ft drop in altitude between observations. These data points suggest the importance of time in the sequence of events. With the exception of GW's recollection, the recollected data are compatible with the systems data before 1022L. And most importantly, the recollected data consistently diverge after 10:22am. The pattern suggests that the watchstanders were tracking one aircraft before 10:22am and a different aircraft after 10:22am.

Figure 3 yields other provocative data concerning the time period of 10:22am:

- FC-1 hooked TN 4474 for five seconds at a range of 110 NM, bearing of 139 degrees, altitude of 11, 900 feet, and speed of 448 knots.[25]
- 49 ADT recalled a contact with an altitude of 12,000ft, 3,600 higher than the system data as shown in Figure 3;

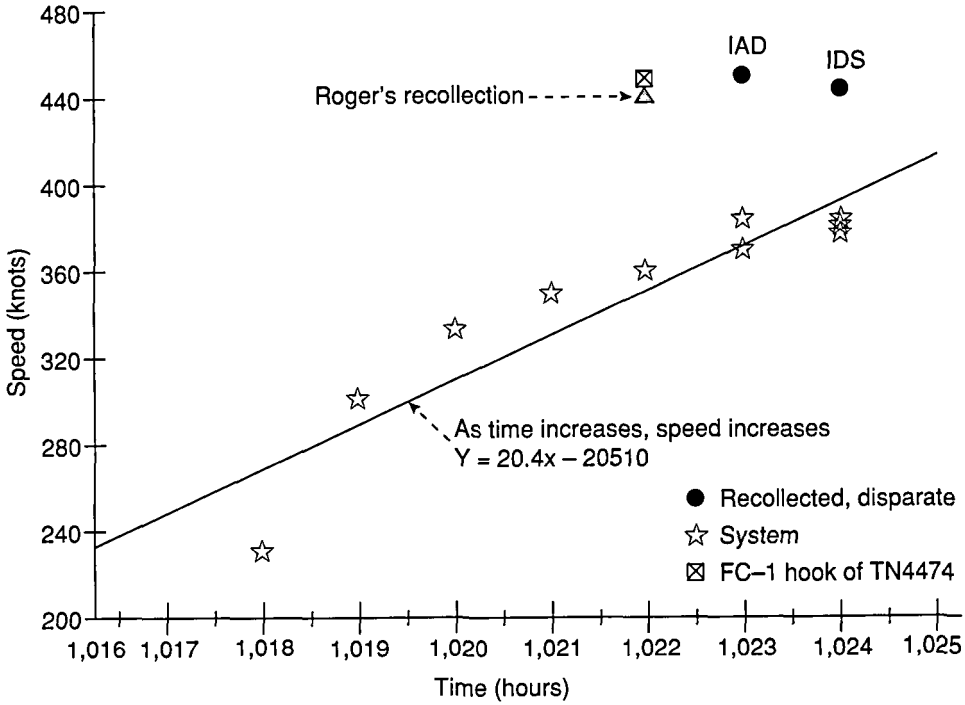

Figure 4 System & Recollected Data Combined – Speed vs. Time

- Captain Rogers asked at 20 NM, "What is 4474 doing?"[26] (He was unaware that the track number of Flight 655 had been changed to 4131). Over the communication net came the reply: "TN 4474 descending, speed 450 knots."[27]
- The UK Type 42 destroyer HMS *Manchester*, entered into the southern Persian Gulf link at or slightly before 10:22am and brought with it the kinematics for a A-6 Intruder on a surface air combat patrol (SUCAP) mission in the Gulf of Oman. The A-6 was assigned a track number of 4474 by the *Spruance*.[28]

These events illustrate the convergence among independent data points in terms of time, altitude, speed and track number. It is very likely that TN 4474, identified by FC-1 (system data) at 10:22am, flying at an altitude of 11,900 feet, at a speed of 448 knots and at a range of 110 NM, was the same plane that the communication net recollected identifying as TN 4474 flying at 450 knots and descending. And it is equally likely that 49 ADT, the first of the highly disparate recollected data entries, picked up the same aircraft, which he remembered as flying at 12,000ft. From that point on, the recollected data are consistent with a descent profile, as we see in Figures 1 and 3. Again, the pattern is consistent with the existence of two planes.

We see the same pattern when we plot speed against time in Figure 4. There is a linear relationship of the system data for Flight 655, indicated by a "star", with ranges in speed from 232 knots to 385. We also see four other data points that are not consistent with this linear relationship: the FC-1 system data which indicates a speed of 448 knots; the recollected data from the IAD and the IDS which indicates speeds of 450 and 445 knots respectively, and Rogers's recollection of a speed of 450 knots at the critical 20 NM launch envelope for air-to-surface weapons. All four speed values are within a five-knot range of one another – a very close relationship considering the diversity of the sources. And all four register speeds well beyond the top speed recorded by Flight 655. Again, the scatterplot suggests a pattern consistent with the existence of two planes rather than one.

In summary, system data and recollected data drawn from the unclassified version of the Fogarty Report, when plotted in terms of altitude, speed, range and time, reveal profiles that are consistent with the existence of two aircraft. What makes these data even more compelling is the system data evidence that indicates that the track number (TN 4474) was assigned to two different aircraft at two different points in time: first, to Flight 655, and then to a flight at a range of 110 NM from the *Vincennes*. Thus, we do not find it inconsistent with the data drawn from the Fogarty Report to suggest that there were two aircraft whose identities were confused due to the transposition of track numbers.

CONCLUSION

This re-examination of the data from the Fogarty Report should be viewed with the customary caution. First of all, there are many unanswered questions about the *Vincennes* incident as the various hearings, reports and articles attest. Our research addresses only one aspect of a very complex case, so it should not be interpreted and applied beyond the limited confines to which it was directed – the flight pattern of 655 and the possible transposition of track numbers between two aircraft. Secondly, data do not necessarily "prove" anything; they merely lend support or fail to lend support to a particular hypothesis or position. In this case, the data and our analysis do support Captain Rogers's explanation of the discrepancy between the system data and the recollected data. In fact, we find them to be a relatively "good fit" with his explanation – that there were two aircraft and their track numbers were transposed. However, since the Fogarty Report provides a limited amount of the system and recollected data, we would recommend full disclosure of the geographic track files of the vessels and the air contacts of those involved to settle this matter once and for all.

There has been a very important "lesson learned" for us in conducting this research, and we suspect for others who have been involved in event reconstructions – especially military events of the *Vincennes*'s magnitude. Event reconstruction is an enormously difficult task and it needs special expertise to do it well. In the *Vincennes* case, for example, hundreds of people had to be interviewed and hours of system data analyzed, second by second. A very large data base with both

qualitative and quantitative information had to be constructed and synthesized. In addition, issues of foreign policy and national security, the history and context of the region and the combatants, the rules of engagement, the military command structure and its communication process, the training and experience of the crew, and the readiness of the ship had to be considered. Also, in the case of sophisticated weapons systems such as Aegis, which have been "battle tested" more in training exercises than in combat, questions had to be asked of the complex technology's performance and the crew's skills in its employment. Thus, a staggering amount of data had to be processed, requiring considerable time and expertise for collection, analysis, synthesis and interpretation.

Time was of the essence. It was important to hold people accountable if culpability was indicated, exonerate the innocent, and explain to the American public and the international community what happened and why. Most importantly, if mistakes were made, corrective action had to be taken to reassure people and nations that it would not happen again.

Yet, how much do we know about event reconstruction? And how good are we at it? We know there is a trade-off between time devoted to an investigation and the quality of its findings. The push for immediate answers can create distortions and factual inaccuracies that not only cause confusion, but later can also fuel the flames of conspiratorial theory, especially if later "facts" contradict earlier ones. For example, the earliest reports had Flight 655 flying outside the commercial corridor, descending, and picking up speed when it advanced toward the *Vincennes*. In reality, always ascending, the Iranian airliner remained within the boundaries of the commercial corridor and continued to fly in an ascending profile.

We also know that there can be significant difficulties with the data collection process. In this instance, questions have been raised whether all key witnesses were interviewed (eg., the commanders on board the *Forrestal*, and Captain McKenna, the surface-warfare commander in Bahrain).[29] Others have charged that certain data, such as the information from the Navy journalists on board the *Vincennes* during the incident, were not submitted to the formal board of investigation.[30]

Some critics use these potential lapses in the data collection process as evidence of a conspiracy or "cover up".[31] An equally plausible explanation is that investigators cannot immediately identify the "key people" in an event, nor do they necessarily know how to ask the right questions, manage the enormous amount of information collected, or follow potentially important leads. Data gathering, analysis and management are far from automatic processes. They require not only ingenuity but also specialized skills. Furthermore, once collected, data do not automatically produce facts or even a reasonable interpretation of facts. Data must be reviewed, analyzed and interpreted against a back-drop of competing hypotheses and explanations. This likewise requires a special set of research skills. The real question for us, and we suspect for others who have participated in accident investigations, is how well do we prepare our investigators to engage in such a research effort? To what extent do officers have the skills and expertise to undertake this type of research assignment, especially under time pressure and international

scrutiny? Those expert at driving ships are not necessarily expert at data collection, analysis and interpretation.

Lest some accuse us of blindness to potential conspiracy or cover-up, we have only to remind them of the lapses in data collection and analysis that our brief study revealed: no discussion of the track number problem in the Fogarty Report; no consideration of a second plane; an inconsistency between what the medical team found among the *Vincennes* crew and what was later summarized in the Fogarty Report. Rather than consider these examples as evidence of a conspiracy or cover-up, however, we believe a likely interpretation lies in the inability of the investigators to interpret data that did not converge to form a coherent pattern. Finding a discrepancy between system data and crew's recollections, and unable to explain it, the investigators speculated that the problem had to be due to task fixation, scenario fulfillment and combat-induced stress. Perhaps, given the pressure of time, it was easier to find fault with the operators than to leave a critical or embarrassing question unanswered or to challenge the efficacy of tactical support systems such as NTDS (Link 11).

The real irony of the *Vincennes* case may be that the investigators themselves set up a scenario that was eventually fulfilled by the five research psychologists. During their congressional testimony, the psychologists asserted that, based on their reading of the Fogarty Report, stress was indeed a factor in the downing of the Iranian Airbus. Given this "finding", they advocated more research money be allocated to study of combat decision-making under stress. Congress and ONR obliged and authorized the program TADMUS. As the self-fulfilling "solution" came full-circle, the studies spawned from this project then used the *Vincennes* case to highlight "the question of how stress can affect decision-making".[32] Speculation about "combat stress" seems to have become an established "fact" during congressional testimony and a "well established fact" by the time ONR set up the TADMUS program and had allocated millions of dollars to study tactical decision-making under stress in order to attract researchers to solve "the problem".

In summary, at the risk of setting up another scenario for someone else to fulfill, we recommend a policy debate on the merit of establishing permanent teams of specially trained officers to assist investigators of these types of accidents. A discussion of their preparation, education and necessary skills would be an important part of the dialogue. Central to the discussion also should be how to prepare people to tackle event reconstruction – whether certain models or approaches are more useful than others. For example, the *Vincennes* investigators used a finely-grained time line to organize their data. In her research on the *Vincennes*, Dotterway[33] not only used a time line, but also experimented with organizational and cybernetic models to identify the "causal" factors in the shootdown, gaining different insights from each model. If officers continue to operate in harm's way, (and world events provide increasing evidence that they will have that opportunity), then we will need to find ways to ensure that when a follow-on investigation is required, it will be as professional as we expect, and demand, the officers' service to the country to be.

NOTES

1. *Formal Investigation into the Circumstances Surrounding the Downing of a Commercial Airline by the USS Vincennes*, by Rear Admiral William M. Fogarty, USN, 28 July 1988, pp. 4, 6. Hereinafter referred to as the Fogarty Report.
2. Personal communication with Commander John Matecvun, 16 July 1992.
3. Senate Hearing Before the Committee on Armed Services, US Senate, One Hundredth Congress, 8 September 1988.
4. US House of Representatives, Hearing Before the Committee on Armed Services, One Hundredth Congress, 6 October 1988.
5. *Storm Center*, by Captain Will Rogers, Sharon Rogers and G. Gregston, Naval Institute Press, (1992).
6. *Systematic Analysis of Complex Dynamic Systems: The Case of the USS Vincennes*, by Captain Kristen Ann Dotterway (USAF), Unpublished Master's Thesis, Naval Postgraduate School, 1992.
7. "The USS *Vincennes*: Public War, Secret War", ABC News Nightline, air date 1 July 1992.
8. "Sea of Lies", by John Barry and Lieutenant Colonel Roger Charles, *Newsweek*, 13 July 1992, pp. 29–39.
9. "*Vincennes*: A Case Study", by Lieutenant Colonel David Evans, *Proceedings*, August 1993, pp. 49–56.
10. See also Commander David R. Carlson's letter to the editor, *Proceedings*, September 1989, pp. 87–9, 92.
11. Fogarty Report, pp. 42–4.
12. Fogarty Report, p. 45.
13. Fogarty Report, p. 45.
14. Personal communication, Commander John Matecvun, 16 July 1992.
15. *Storm Center*, p. 101.
16. *Storm Center*, p. 102.
17. *Storm Center*, p. 117.
18. *Storm Center*, pp. 117–18.
19. Senate Hearings, p. 16.
20. Senate Hearings, p. 5.
21. American Psychological Association, *Science Agenda*, Fall, 1988, p. 4.
22. "*Vincennes*: A Case Study", p. 54.
23 "Counterbattery", by Captain Will Rogers, *Proceedings*, August 1993, p. 58.
24. Fogarty Report, pp. 29–39.
25. Fogarty Report, p. 34.
26. *Storm Center*, p. 117.
27. *Storm Center*, p. 15.
28. *Storm Center*, p. 117.
29. "Sea of Lies", p. 39.
30. "Letter to the Editor", by Captain John J. Kiely, *Proceedings*, 1993, p. 29.
31. "Sea of Lies", and "*Vincennes*: A Case Study".
32. See for example "The Effect of Acute Stressors on Decision-Making", by G. Klein and C.E. Zsambok, Unpublished paper, April 1992, p. 1.
33 *Systematic Analysis of Complex Dynamic Systems*