Attachment I

A Brookhaven National Laboratory Report with
Analyses of Suspicious TWA Flight 800 Debris Items

Note: A summary by the Flight 800 Independent Researchers Organization precedes the Brookhaven Report in this attachment

Feb 20, 2002

A Brief Summary of a Declassified FBI Report

Subject: The analysis of evidence with possible high energy characteristics
at the Brookhaven National Laboratory

Tom Stalcup, Feb. 20, 2002

A recently declassified FBI report presents the results of an analysis of TWA Flight 800 debris "*that exhibited possible high energy characteristics*" and other items of "*unknown origin*."[1] The FBI and NTSB contracted scientists from the Brookhaven National Laboratory (BNL) to analyze these items, but restricted the scientists from sharing their findings with individuals outside the official investigation. The parties to the investigation (e.g. Boeing and TWA) did not participate in this activity.

Some of the items tested are listed below:

Note: All quotations that follow have been taken from the aforementioned report[1] unless cited otherwise.

1. One of 20 similar objects of "*unknown origin*" approximately 0.2 inches in diameter found during victim autopsy examinations.

2. A piece of titanium alloy consistent with jet engine parts that contained "*spike fractures*" and "*melting."*

3. Part of the left side of the aircraft that contained a penetration apparently "*directed into the fuselage.*"

The FBI report is a summary of the BNL activities and is apparently missing some pages and attachments. Its "Executive Summary" seems to conflict with the findings presented in the body of the report.

The summary reads "*no material compositions were found to indicate the presence of non-TWA Flight 800 or weapons related materials*," but item 1 (listed above) was inconsistent with aircraft wreckage.[1] These pellet-like objects were in fact tested "*because of their dissimilarity in appearance with TWA 800 debris*." After numerous examinations, the report classified their origin as "*unknown.*"

When polished, the objects of unknown origin became "*orange-colored and transparent*." They were non-conductive, and contained Zirconium, Barium, and Cerium within a multi-phase Aluminum-Titanium "*matrix*."

The significant quantity of Zirconium and the presence of Barium is indicative of an incendiary device[3, 4] and the matrix structure of these object is consistent with pellets used in anti-aircraft missiles[1]. Similar pellets were apparently recovered from the bodies

[1]National Defense Magazine stated that "*pellets embedded in a titanium matrix*"[2] are used in anti-aircraft missile warheads.

of victims of a recent missile engagement of a civilian airliner.[2]

Two days after the BNL report was submitted to the FBI leadership, then FBI Assistant Director James Kallstrom sent a letter to the NTSB requesting that the discussion of "*Missile/Warhead Impact/Bombs/Explosives*"[7] be banned from the NTSB public hearing on the crash, scheduled to be held the following week. The NTSB complied with the request and the FBI classified the BNL report as "secret."

Although FBI investigators suspected "*that a missile might have been used against flight 800,*"[6] there is no indication that the any items discussed in the BNL report were ever analyzed by warhead experts. On the contrary, the report mentioned having "*little forensic documentation or guidance on large-body aircraft missile engagements.*"

The characteristics of the items discussed in the BNL report are consistent with a missile engagement. But by not supplying proper guidance, classifying the report as secret, and influencing the agenda of a public hearing, the FBI leadership reduced the likelihood of this evidence ever becoming proof.

References:

1. FBI, *TWA Flight 800 Brookhaven National Laboratory Examinations.* Declassified FBI Report, 1997.
2. Ezell, V.H., *Experts Question Lethality of OICW Warhead.* National Defense Magazine, .
3. Durgapal, V.C., A.S. Dixit, and R.G. Sarawadekar, *Study of zirconium-potassium perchlorate pyrotechnic system.* Proceedings of the International Pyrotechnics Seminars, 1988. **13**.
4. Taylor, F.R. and L.R. Lopez, *Development of a reliable, miniature delay system using zirconium / nickel alloys - potassium perchlorate - barium chromate.* Proceedings of the International Pyrotechnics Seminars, 1991. **16**.
5. Pravda, *UKRAINE DENIES MISSILE HITTING RUSSIAN LINER. "UNCONVINCING," SAYS AIR FORCE MARSHAL.* Oct. 9, 2001, Pravda.ru, 2001.
6. Mayer, D., *Witness Group Study Report.* NTSB Public Docket, 2000.
7. Kallstrom, J., *Dec. 3, 1997 Letter to NTSB Chairman Jim Hall Regarding Objections to Hearing Items.* NTSB Docket, 1997.
8. Bott, R., *TWA Flight 800 Missile Impact Analysis.* NTSB Public Docket, 1997.

[2] In the recent missile engagement of a Sibir Airlines aircraft over the Black Sea, "*metal articles* [were] *found in several bodies* [that] *closely resembled in shape and weight pellets inside S 200 missiles.*"[5]

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265A-NY-259028

TWA Flight 800

Brookhaven National Laboratory Examinations

ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED EXCEPT WHERE SHOWN OTHERWISE

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SA [redacted]
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December 1, 1997

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FEDERAL BUREAU OF INVESTIGATION
TWA Flight 800, Case 265A-NY-259028
Naval Weapons Industrial Reserve Plant
Calverton, New York

TWA Flight 800 Brookhaven National Laboratory Examinations

Date of Report: December 1, 1997

EXECUTIVE SUMMARY

Brookhaven National Laboratory was asked by the FBI to assist in the Trans World Airlines (TWA) Flight 800 investigation by providing scientific support. Its scientists graciously donated both expert advice and laboratory examinations of several evidence items.

Selected debris items and impact sites on the wreckage of TWA 800 that exhibited possible high energy characteristics were submitted to Brookhaven scientists for microscopic examination and chemical identification. No damage, characteristics, or material compositions were found to indicate the presence of non-TWA Flight 800 or weapons related material.

PROJECT CONTRIBUTORS

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BACKGROUND

It became apparent by the end of November 1996, about four months into the FBI's criminal investigation, that no aircraft debris recovered to that time had clear indicia of a high explosive event, although evidence recovery (i.e. ocean trawling for aircraft debris) and subsequent examination by bomb technicians for such indicia was continuing. In the face of no "classic" explosive artifacts,[1] little forensic documentation or guidance on large-body aircraft missile engagements, and no supportable mechanical or operational explanation for the crash of Trans World Airlines (TWA) Flight 800, FBI management decided that "...any investigative or scientific avenue that was reasonable and which could assist in providing a factual cause of the incident should and would be pursued."[2]

To supplement the already extensive scientific effort the FBI Laboratory was applying

[1]Bomb technicians and FBI Laboratory scientists often cited, based on their experiences, the associated presence of variable-depth surface pitting, melting, penetrations, spalling, and hot gas impingement as examples of classic explosive artifacts.

[2]FBI New York Electronic Communication by SSRA [redacted] January 7,1997, case file 265A-NY-259028 serial 1186. b7C

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to the investigation, provide scientific peer review and a fresh perspective, and to have access to a nearby federal government facility with materials science experts capable of performing advanced imaging examinations in short turnaround, Brookhaven National Laboratory (BNL) was approached for assistance, resulting in a favorable response.[3] The NTSB and FBI Laboratory concurred with FBI New York Office's proposed utilization of BNL and participated in several meetings with BNL scientific staff during January and February 1997 held at both the Director's Office, BNL, and Hangar Six, Naval Weapons Industrial Reserve Plant, Calverton, New York (Calverton facility). During these meetings, participating BNL scientists were briefed on the investigation, introduced to FBI and NTSB investigators, and advised investigators on the scientific capabilities of their labs, offering gratis support that resulted in the efforts reported herein.[4]

At Calverton, the scientists were briefed on, among other topics, the evidence recovery, debris identification and placement, reconstruction projects, scientific observations, and NTSB's crash sequence theory. They were escorted through the TWA 800 debris and reconstruction projects.

Three projects ultimately resulted from this collaboration: metallurgical peer review of the wing center section failure assessment, chemical analysis of an unknown "splattered" material, and examinations of selected evidence items for indicia of high energy penetration. The scientists' project reports are at Attachments (1), (2), (3), and (4).

The cursory metallurgical peer review was conducted by [redacted] Department of Advanced Technology, BNL. His task was to provide an unbiased review of metallurgical findings. No analysis or microscopic examinations were conducted. [redacted] memorandum, Attachment (1), is self-explanatory and will not be addressed further. b7C

The unknown "splatter" material was found at various locations on the top of the wing center section. This location was significant because of the early role the wing center section had in NTSB's sequence theory.[5] Several specimens were taken for analysis by NTSB and

[3]December 1996 meeting between Senior Supervisory Resident Agent [redacted] FBI; Special Agent [redacted] FBI; and [redacted] Planning and Policy, Brookhaven National Laboratory. b7C

[4]As a preface to discussions about the investigation, BNL personnel were informed of the sensitivity of the case regarding possible criminal prosecution and civil litigation. They agreed to restrict discussion and dissemination of related subject matter to those involved in the investigation. None of the non-government NTSB party members (e.g. Boeing, TWA) were involved in the BNL activities.

[5]NTSB's sequence theory points to the ignition of the fuel-air mixture in the center wing tank, part of the wing center section, as the event that led to the catastrophic airframe failure. The ignition source is as of the date of this report unknown. See NTSB Metallurgy/Structures Sequencing Report 97-38. As of the date of this report, NTSB was still studying the relationship and implication the splatter material had to the overall mishap

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the FBI, one of which was submitted to [redacted] National Synchrotron Light Source, BNL. Once a preliminary chemical identification was done, several control specimens from known aircraft structure were submitted for comparison. [redacted] report, Attachment (2), comprehensively documents his analysis and will not be addressed further. b7C

[redacted] conducted materials science examinations, primarily looking for high energy penetrations.[6] The interest in high energy penetrations stemmed from the development of several hypotheses of criminally initiated events that might have accounted for the lack of a classic explosive signature. Among these hypotheses were the possibilities that a missile warhead detonated at some distance external to the TWA 800 airframe, resulting in only a few warhead fragment penetrations of the aircraft, or that an explosive device detonated in or on the aircraft but the explosive signature was, for some reason, masked or attenuated. If either of those scenarios were true, then the evidence of an explosive fragment penetration--amongst the myriad penetration sites throughout the airframe--might be discovered under microscopic examination.

[redacted] first examination was on a non-TWA 800 penetration site that Boeing made by firing a steel projectile through an aluminum alloy plate. [redacted] examination revealed a presence of steel, apparently transferred to the aluminum plate by the steel projectile, anecdotally supporting the possibility of discovering microscopic material from a penetrator in a penetration site. Her report, Examination of the Boeing Test Sample: The Fracture Surface of Al 2024 Alloy Following Penetration by Steel Projectile @ 3000 ft s^{-1} is at Attachment (3). b7C

Subsequently, two evidence items associated with the TWA 800 debris were submitted to [redacted] for examination because of their damage features. FBI evidence item 1B-377 was a penetration site in the vicinity of the L3 door. It appeared to have been made by a penetration directed into the fuselage. As well, the surrounding fuselage skin had various degrees of scraping, dimpling, and fracturing. The area was examined by FBI bomb technicians, yielded no identification of an explosive signature, so the site was cut from the fuselage and submitted to [redacted] whose report is at Attachment (4). b7C

The other item of intriguing appearance was 1B-423. This piece was recovered during trawling. There was no way to confirm that it came from the TWA 800 aircraft, but bomb technicians pulled the item aside because of its spike-feature fractures. To discover the item's composition and to search for possible transferred material, it was subjected to microscopic examination by [redacted]

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sequence.

[6]High energy in this context denotes a penetrant of such mass and/or velocity sufficient to leave certain characteristics in the penetration site, such as those identified in [redacted] Boeing Test Sample report at Attachment (3). b7C

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Two other items, 1B-410 and -28, were submitted for identification because of their dissimilarity in appearance with TWA 800 debris, not for any particular damage features. This examination was an attempt to discover any probative characteristics in the material and was performed by BNL because of their close proximity to Calverton and fast turnaround.

METHOD

All items were tracked and documented as evidence. Unknown evidence items submitted for examination remained in the custody of SA [redacted] throughout. Items of known identity or samples extracted from an item were released into the custody of Brookhaven personnel only when necessary. The following four items were examined by [redacted] Materials Science, BNL:[7]

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1B-28

This item, one of 20 similar pieces removed during autopsy of Suffolk County Medical Examiner's case [redacted] was approximately 5mm in diameter and charcoal colored. The item was polished and then subjected to an energy dispersive spectrometer (EDS) analysis to determine its chemical composition.

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1B-377

The item was a 5 x 5 cm square piece with a penetration at its center, cut from the fuselage aft of the L3 door. EDS analyses were performed on both of its fracture surfaces, the external coated areas, and indentations. The item was also analyzed using a synchrontron x-ray fluorescence microprobe.

1B-410

The item was a sliver of grey uncoated material that was submitted to BNL for an EDS analysis. No further tests were required.

1B-423

Item 1B-423 was transported to BNL for testing. An EDS analysis was performed on three areas: the spike-feature fracture surface, the green colored area, and the base of the "teeth" at some apparently melted areas. A small piece was cut from 1B-423 and mounted in an epoxy resin to facilitate alloy identification. This cut piece was released into [redacted]

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[7] Attachment (4), Materials Analyses of Samples from TWA Flight 800.

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2. 7) Spectrum is consistent with oxidation of base alloy material (O, Ti,

This specimen shows evidence of fast fracture and possible transfer of Fe at the fracture surface. It should be noted however, that Fe is a common impurity in Ti alloys resulting from the extraction process (up to 0.2 wt. % for the most commonly used "Kroll" process - see Table 1 - from "The physical metallurgy of Titanium Alloys, [redacted]. The bulk alloy is possibly engine material used on the aircraft (49XX series Ti alloys) and further tests are presently underway in order to match the sample to actual engine pieces (see Appendix 1). Currently the origin of the piece remains unknown.

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Sample ID # IB410 (item 86) - "fin"

Sliver of grey uncoated metal - *Unknown origin*

EDS spectrum of sample (unwashed) indicated the material to be Al based with Cu and Fe (consistent with a 2000 series alloy used in aircraft), additional peaks from salt contamination (Na, Ca, Cl, K, S, Mg) were also observed. No further tests were required.

Sample ID # IB28

Small charcoal colored particles (1 of ~20 similar pieces) measuring ~5 mm in diameter. On polishing the sample was orange colored and transparent. *Unknown origin.*

SEM analysis indicated that the material was multi-phase having a base matrix containing Al and Ti (Fig. 9). The sample showed significant charging under the electron beam indicating that it is a very poor conductor - i.e. not metallic. Three other distinct areas could be observed, two were similar to the matrix but contained significant amounts of Zr (Figs. 10,11), the other was mostly Al with Ca, Ba and Ce (Fig. 12).

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Table 1 — Total Impurity Contents of Iodide- and Kroll-Process Titaniums in Weight %

Element	Iodide Ti	Kroll Ti
Mg	0.01	0.13
Si	0.01	0.05
Al	0.02	
Fe	0.01	0.20
Ni	0.01	
Co		0.02
Cr	0.01	
Mn	0.005	0.02
C	0.01	0.08
N	0.02	0.04
O	0.02	0.11

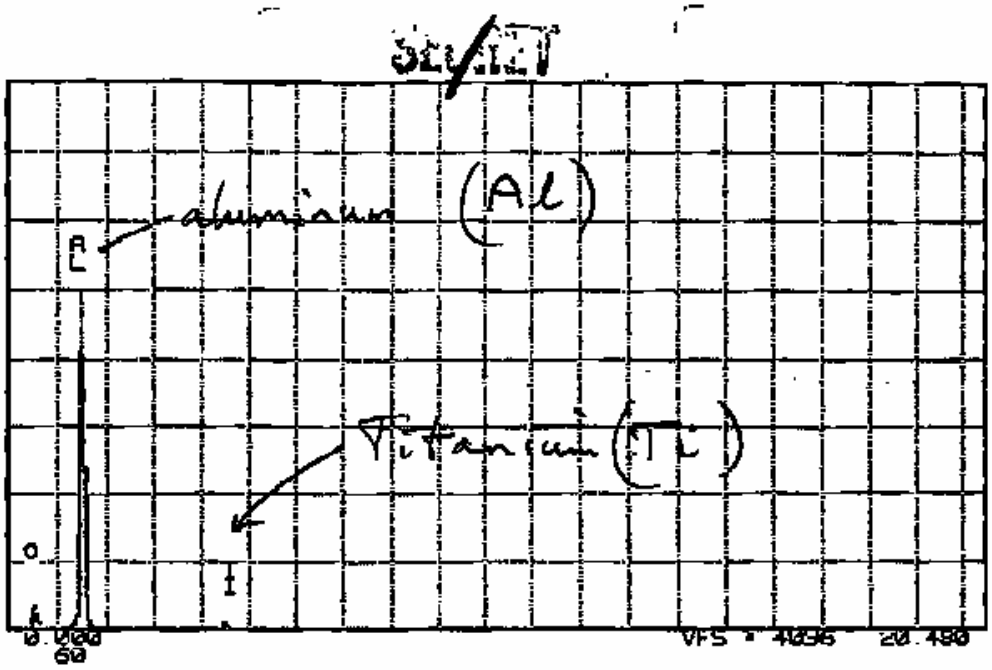

Figure 9. EDS Spectrum of IB 28 - Matrix

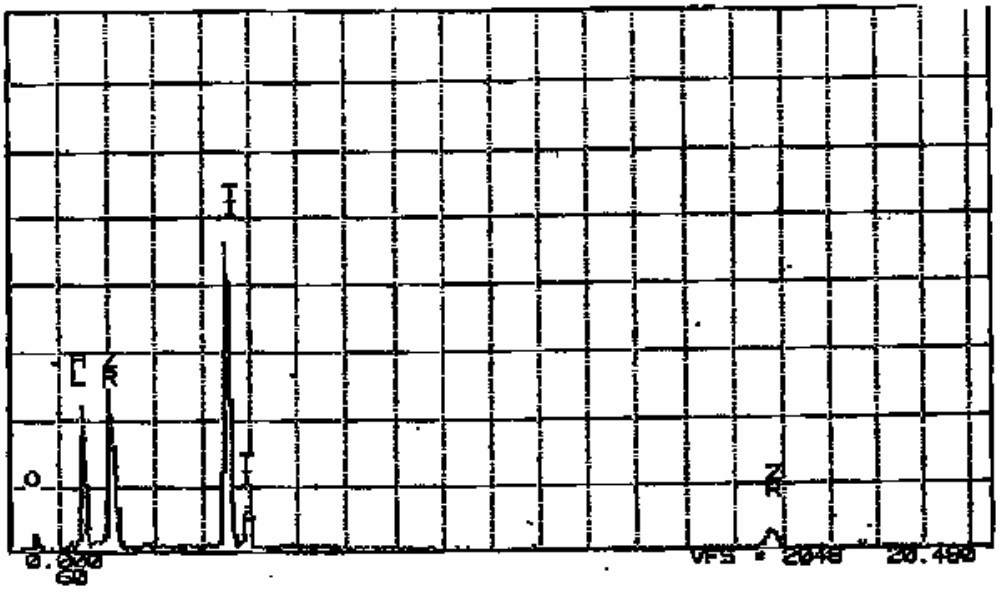

Figure 10. EDS Spectrum of IB 28 - Particulate 1.