

UNITED STATES DISTRICT COURT  
FOR THE DISTRICT OF COLUMBIA

TRIPOLI ROCKETRY ASSOCIATION, INC., and )  
NATIONAL ASSOCIATION OF ROCKETRY, )

Plaintiffs, )

v. )

UNITED STATES BUREAU OF ALCOHOL, )  
TOBACCO, FIREARMS AND EXPLOSIVES, )

Defendant. )

Civil Action No. 00-273 (RBW)

**AFFIDAVIT OF DAVID S. SHATZER**

I, David S. Shatzer, do hereby depose and say:

1. My name is David S. Shatzer. I am employed by the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) as an Explosives Enforcement Officer/Program Manager. My current duties include: providing technical advice to the Assistant Director, Enforcement Programs and Services and the Chief, Arson and Explosives Programs Division. I conduct research and technical review of explosives materials and provide additional technical advice to other Federal departments and agencies as well as foreign governments. I have evaluated over 1,000 devices and other materials for classification under the Federal explosives and firearms laws, and have testified as an expert over 25 times in Federal and State courts. I am also the ATF representative to the National Fire Protection Association (NFPA) Technical Committees on Explosives, Pyrotechnics, Rocketry, Special Effects and Hazardous Materials. I have been employed by ATF for over 17 years.

2. Prior to my employment with ATF, I was employed by the United States Army from November 1983 until September 1989. I served as an Explosives Ordnance Disposal Team Leader, with a duty station of Cape Canaveral Air Force Station, Patrick Air Force Base, Florida. My duties included: identifying and rendering safe foreign and domestic chemical, biological, nuclear and conventional ordnance and Improvised Explosive Devices, as well as disposal of unexploded ordnance as required. I completed

Phases I-III of the Joint Service Explosive Ordnance Disposal School in January 1985, and completed numerous advanced schools in that field.

3. I received a Bachelor of Science degree in 1976 from The Pennsylvania State University.

4. Safety fuse is a recognized explosive material in 18 U.S.C. § 841(d) that functions by a filler of black powder, another recognized explosive material. Safety fuse has a primary or common purpose to function by explosion, including the initiation of other explosives. Other explosives similar to safety fuse and also listed in 18 U.S.C. § 841 include igniter cord and igniters. Safety fuse, as well as igniters and igniter cord, are classified in 27 C.F.R. § 555.202(b) as "low explosives" or explosives which can be caused to deflagrate when confined.

5. Safety fuse functions by a completely contained internal deflagration of black powder, with no visible external explosive effects. The indication that safety fuse is functioning is when smoke escapes from the initiated end, or from small holes in the waterproof covering that are weakened by the heat of the deflagration reaction passing through the fuse. Safety fuse was invented in 1831 to provide a safe method for transmitting a controlled, non-exposed explosive effect over a distance for the safe initiation of black powder used in mining. Safety fuse is designed to prevent any sparks or external explosive effects from accidentally initiating nearby explosive materials. Safety fuse was later improved by making it waterproof, so that it would function underwater. Safety fuse is still in worldwide use today.

6. Safety fuses, like almost all commercially produced explosives, explode at a controlled rate as designed by the manufacturer for the purpose intended. As such, rates vary widely.

7. To establish whether a material deflagrates, ATF chose and tested the low explosive safety fuse as a baseline measurement. In particular, ATF chose specific types of safety fuse that complied with published, accepted standards for performance and use. Notably, ATF's tests are consistent with those tests published by the International Society of Explosives Engineers (ISEE). See AR II at 1561 (ISEE Blaster's Handbook, 17<sup>th</sup> Ed., at p. 159, identifying a burn rate for safety fuse of 131m/s, or approximately 7.63mm/sec).<sup>1</sup>

8. In the video showing the catastrophic failure of the G40-10W rocket motor, see Agency Decision at 4, the APCP stopped burning when the motor casing ruptured. This outcome was predictable and consistent with the characteristics of a low explosive.

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<sup>1</sup> The ISEE Handbook refers to testing safety fuse "unconfined" to determine burn rates. Unconfined in this specific instance means in the open, i.e., on the ground; and not confined by something external to the fuse itself. The ISEE tests are comparable to ATF's tests. As noted previously, safety fuse provides for its own internal confinement, e.g., a contained internal deflagration of the black powder core. Internal confinement is provided by the fuse's waterproof fiber/fabric lining or covering. See ¶¶5, 9.

It is a well-known characteristic of low explosives to require confinement to deflagrate; it is similarly well-known that removal of confinement of low explosives will result in the reaction stopping.

9. As ATF has indicated, low explosives “deflagrate, in the absence of atmospheric oxygen, including when confined.” See Agency Decision at 2. “Confinement” for these purposes means any contrivance or mechanism capable of containing an explosive reaction to the extent that the explosion continues to progress, or enabling the material to sustain its own reaction with insufficient oxygen. This can be as minimal as the fiber/fabric lining of safety fuse, to a rocket motor casing, to a section of pipe. Confinement is required for certain deflagrating explosives, as they require pressure in excess of atmospheric pressure to function as designed. Removing confinement from these explosives causes the reaction or burning to decrease, or stop entirely. An example would be a pipe bomb filled with a low explosive propellant. After the pipe bomb is initiated, the propellant ignites, and reacts under pressure, exploding and breaking the pipe into fragments. After the explosion, the propellant ceases to deflagrate, and unburned propellant remains on the pipe, or in cracks in the pipe.

10. The total burn time of propellant (APCP) in a rocket motor is influenced by a number of factors. These factors include: how fast the propellant burns over a linear distance, the amount (weight or volume) of the propellant, propellant geometry (or the ratio of the length of the propellant to the diameter of the propellant), the exposed surface area of the propellant, and the confinement of the propellant. The propellants in four of the rocket motors tested had some similar characteristics: the propellants all had approximately the same overall diameters and were all confined by a casing of some type. Since the diameters of the propellants were nearly constant, the propellant geometry varied only in proportion to the propellant lengths. Likewise, the amounts of propellant in the rocket motors also varied in proportion to propellant lengths. As the propellant geometry, the amount of propellant, and the surface area are all proportional to the length, the burn rate can be estimated by measuring the burn time of each motor, as well as the motor length, and dividing the burn time by length.

11. The linear method was utilized because the burn time and the length of the propellant or APCP are easily measured and provide a means to a reasonable calculation of the burn rate for each propellant. Additionally, safety fuses—the benchmark—burn linearly, as do the common everyday items burned by ATF as a reference point. As such, the linear method provides a reliable measurement for purposes of comparing different types of materials.

12. The APCP burn rates provided by the plaintiffs’ expert are “radial burn rates,” that is burn rates based on a radial measurement. These types of measurements are useful for comparing other propellants with characteristics similar to APCP. However, unlike linear measurements, radial measurements are not useful for comparing APCP to the other types of explosives that ATF must evaluate. Radial measurements address burning in only one dimension at a specific pressure. They do not adequately

measure the burn rates for the purposes of ATF's tests because they do not consider the actual way that a rocket burns. Rocket motor propellants burn from top to bottom, bottom to top, as well as radially, from the inside out. While it may appear that ATF also considered burn rate in only one dimension, this is not the case. Since the diameters of the propellants in four of the rocket motors ATF tested were nearly constant, the difference in the rocket motors was the lengths of the propellants. Therefore, for purposes of ATF's evaluation, the only variable was the propellant lengths, as the propellant diameters were considered a constant. Radial burn rates are not useful for explosives classification purposes, as they do not account for the geometry and mass of the propellant, nor do they account for all of the burning/deflagration on all exposed surfaces of the rocket propellant. Further, the radial burn rates are not effective for classification purposes because they do not provide a reasonable comparison to safety fuses, which burns linearly, and which ATF used as a baseline for comparison purposes to identify materials that deflagrate.

13. Piobert's Law of Combustion states that when a solid grain of propellant is ignited, each surface burns independently and progressively in parallel layers and at the same rate; Piobert's Law is valid only for non-porous powders which *deflagrate*. Thus, if Piobert's Law applies to APCP, then APCP by definition, and the plaintiff's assertion, is a deflagrating explosive.

14. Rocket Propulsion Elements. An Introduction to the Engineering of Rockets referenced by Dr. Terry McCreary, contains a table on page 396 listing 12 different propellants and their characteristics. (AR II at 2077). The ninth propellant on the list is identified as "PBAN/AP/Al," which is a type of APCP consistent with the APCP being evaluated as an explosive in the Agency Decision. In the eighth column of the table, titled "Hazard Classification DOT/MIL" the PBAN/AP/Al mixture is identified as having a DOT Hazard Classification of "B." Class "B," materials, now referenced as "Class 1.3 materials" are low explosives. (AR II at 2192).

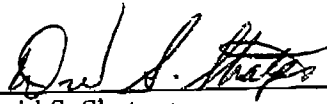
15. The test conducted by the Naval Surface Warfare Center on behalf of NASA was to determine whether the detonation of a specially designed high explosives shape charge next to a NASA solid propellant rocket motor made of APCP would cause the rocket motor to either deflagrate or detonate. NASA recognized that the APCP propellant will deflagrate to propel the rocket into space and will detonate under certain conditions; however the purpose of the test was to ensure this high explosive shape charge properly placed and used as a safety feature in the rocket would not initiate either deflagration or detonation. It is accurate to state the report determined the proper utilization of this high explosive shape charge *as a safety feature* would not cause deflagration or detonation. The test was specifically to determine if one explosive, used as a safety device to relieve the solid rocket booster case pressure, would initiate another explosive (APCP). There are no "non-explosive" NASA solid rocket propellants.

16. Unlike paper, APCP is a chemical compound or mixture composed of Ammonium Perchlorate (an oxidizer), aluminum powder (a fuel) and a polymeric binder. When initiated under confinement, and even in absence of atmospheric oxygen, APCP

deflagrates and continues to "burn" until the APCP is consumed, or the confinement is removed. The APCP when confined, can be in any orientation such as inverted or even horizontal, and deflagrate. Paper, on the hand, requires atmospheric oxygen to burn. In the tests conducted at the ATF Fire Research Laboratory, a sheet of bond paper failed to burn when laying flat on a surface. Similarly, a candle would not burn when ignited while inverted. Both of these common materials cease to burn when confined with no available atmospheric oxygen. See Agency Decision at 4; AR II at 148, 153, 156.

Pursuant to 28 U.S.C. § 1746, I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Executed this 13<sup>th</sup> day of March 2007.

  
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David S. Shatzer  
Explosives Enforcement Officer/Program Manager  
Office of Enforcement Programs and Services  
Bureau of Alcohol, Tobacco, Firearms and Explosives  
United States Department of Justice