

# Detecting the “Handiwork of Terrorism”: The history of geopolitical motivation and technological development of the PD trace vapour detectors for explosives during The Troubles

## Introduction

During the 1970s, the British military was in need of a portable explosives vapour detector. The Procurement Executive of MOD supported contracts with private company Pye Dynamics leading to the development of the PD 1 electron capture trace vapour detector, fielded to soldiers ca. 1974. Using oral history and original company documents, we can trace the progress of and gain insight into the motivations for development.

## Pye, Ltd

In 1898, William George Pye founded a company to manufacture precision scientific instruments, gaining renown among laboratories. Over the next forty years WG Pye branched into five divisions, each with a specialized focus in technology, and with a strong connection to developing instruments for government needs.<sup>1</sup>



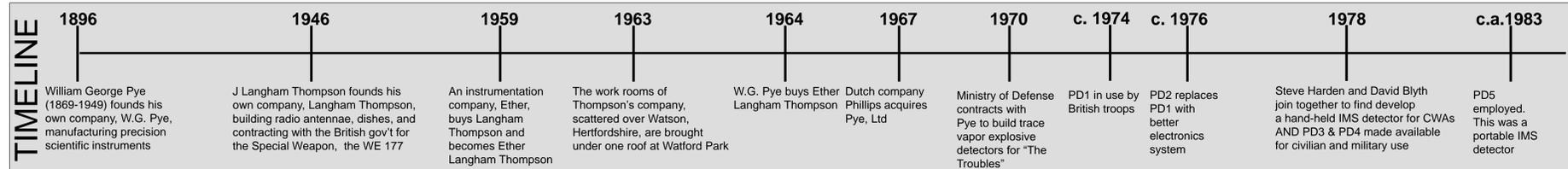
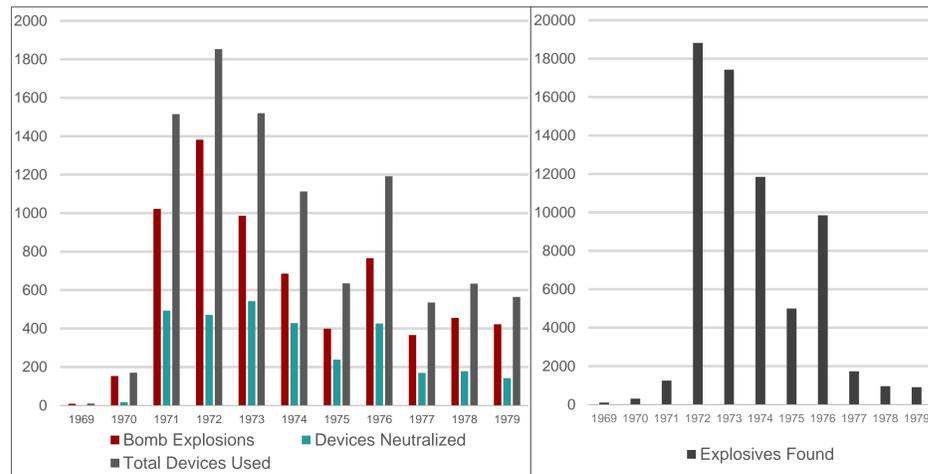
## John Petinarides



In 1965, Pye acquired Ether Langham Thompson. Among Ether's employees was young apprentice toolmaker John Petinarides. He had joined in 1960, progressing through training with Pye and its subsequent company mergers until it settled as Graseby Dynamics. He rose to electro-mechanical engineer and worked on a range of precision scientific instruments for medicine, chemical detection and weapons systems.<sup>2</sup>

## The Troubles

In the late 1960s, Irish political action and protest erupted into major violence, known as the Troubles. By 1970, the UK Ministry of Defense sought a company with which to develop “a crash programme...to complete a development and production program in two years for an equipment capable of detecting explosive vapours which was simple to use and rugged. Pye Dynamics, Ltd was the firm selected...”<sup>3</sup>



## PD Development

*As I looked upon them, I can assure you there was nothing glorious, nothing beautiful about the handiwork of terrorism*  
 ~Unionist MP William McCrea<sup>4</sup>

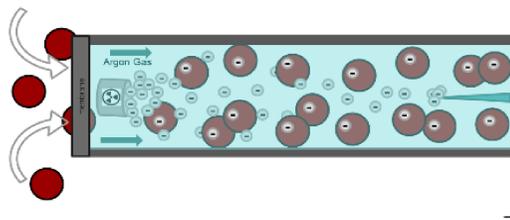
### Overview

Motivated by the catastrophic effects of explosives, the British government contracted with Pye Dynamics, whose scientists sought detection capabilities through a portable, reliable, fieldable instrument. Initial scientific principles and technology proved problematic and eventual improvements in explosives detectors included a complete shift from electron capture to ion mobility spectrometry.

The success of the PD detectors quickly moved them from the battlefield into civilian arenas such as airports, where explosives detectors remain and cutting edge technological improvements are implemented.

### The PD1 electron capture detector

Initial development used the principles of electron capture and since the majority of explosives vapors British military forces were searching for at the time are electron-hungry, this device, called the PD1, had relative success.

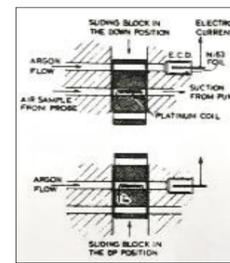


- Some PD3 Improvements
- Single hand-held unit—no brief case
  - Weighs 750g
  - Uses electrostatic in detection
  - Replaced argon with purified air
  - 2-3 second warm-up time

While the PD1 and its successor, the PD2, were very sensitive, they continued to lack selectivity and detection time took 16 seconds. Initial design was bulky and the PD1 weighed 39 pounds. The PD2 was designed to fit in a slim, portable briefcase-like kit. But drastic design changes made the PD3 the first of the family to meet modern standards for detectors.<sup>5</sup> In the PD3 and PD4, electron capture in noble gas atmosphere was replaced with ion mobility filter in purified air. The PD5 and PD6 used a complete ion mobility spectrometry drift tube housed in a briefcase.

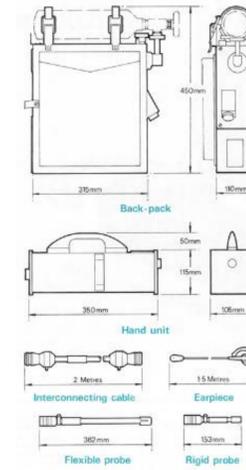
### Robert Bradshaw

Bradshaw's development of the PD1 relied upon adsorption of explosive vapours on a platinum coil. Under a reverse flow of argon, the platinum was resistively heated to desorb explosives into the electron capture detector.<sup>6</sup>



Bradshaw would advance trace explosive vapour detectors in electronics and pneumatics and extend into air based methods of ion mobility filters. In 1972-73, Porton Down physicist David Blyth approached him to help with the amplifier for the DICE (Detection by Ion Combination Effect). Bradshaw's patented electronic amplifier for PD development allowed them to pursue the previously impossible scientific field of ion mobility spectrometry, partnering with American chemist, Steve Harden. The line of PD detectors continued with electron capture until the PD 5 and 6, which used a miniature ion mobility spectrometer, a legacy technology from the Chemical Agent Monitor (CAM), fielded to soldiers for chemical agent detection.<sup>7</sup>

### PD1



### PD2



### PD3



### PD4



### PD5



### PD6



## Conclusions

Through oral history interviews and original documents, the story of the individuals developing the PD explosives detectors and details of technological development reveal a pattern of impact: geo-political motivations for military necessity met by individuals within private companies. Technology was created in context using transferable experience and knowledge. In this case, Robert Bradshaw honing his skills in electronics for the PD detectors, and John Petinarides building instrumentation, used those same skills in the development of the Chemical Agent Monitor (CAM), linking together cutting edge technology in trace vapour detection for different chemicals. The PD3 and 4 can be considered precursor technology to CAM, which won the Queen's Award for Enterprise: Innovation (Technology) in 1988, and the PD5 and 6 are legacy technology.



Electron capture technology was superseded by ion mobility spectrometry technology in the service of trace vapor explosives detection.

### Cited Sources

1. <http://pyemuseum.org>.
  2. Mr. John Petinarides, interviewed by Dr. Gary Eiceman and Dr. Paul Thomas, Albuquerque, NM July 2010, transcript, Las Cruces, NM.
  3. John A. Reed, "Technology in Support of Security Development of Explosives Detection Equipment in the United Kingdom," *New Concepts Symposium and Workshop on Detection and Identification of Explosives* (1978): 191.
  4. Tony Geraghty, *The Irish War: hidden conflict between the IRA and British Intelligence* (London: HarperCollins Publishers, 1998), 215.
  5. "Detection to cut out the big bang," *New Scientist*, 13 April 1978. Looking for electron-hungry explosives in Ulster," *New Scientist*, 9 May 1974.
  6. Robert Bradshaw, "Platinum in Explosives Detectors, Unique Surface Properties Successfully Utilised," *Platinum Metals Review*, 21 no. 4, (1977): 130.
  7. Mr. Neil Underwood, interviewed by Dr. Gary Eiceman and Abigail Eiceman, Porton Down, Salisbury, England, July 2014.
  8. "Detection to cut out the big bang," *New Scientist*, 13 April 1978. Looking for electron-hungry explosives in Ulster," *New Scientist*, 9 May 1974. Other two photos courtesy of the internet.
- Thanks to Smiths Detection for original and photocopies of PD produce brochures.