

# Carlos Fernandez-Pello, PhD

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## Current Position

Partner, Reax Engineering, Inc. – Berkeley, CA

## Education

PhD – Engineering Science, University of California, San Diego, 1975

MS – Engineering Science, University of California, San Diego, 1973

Dr. Eng – Aeronautical Engineering, Polytechnic University of Madrid, Spain, 1979

Eng – Aeronautical Engineering, Polytechnic University of Madrid, Spain, 1968

## Overview

Carlos Fernandez-Pello specializes in the analysis of combustion and fires. With more than 30 years of fire litigation experience, Dr. Fernandez-Pello has testified as a fire expert witness in several State and Federal courts. His fire litigation activities have involved analyzing many aspects of fires such as ignition of solid, liquid, and gaseous fuels; flame spread and fire spread; flammable liquid pool fire burning; self heating and spontaneous combustion; smoldering and transition from smolder to flaming; ignition of spot fires by embers and heated particles; wildland fires; vehicle fires; warehouse and industrial fires and explosions; laptop fires; smoke detector product liability; residential fires; fire reconstruction and modeling; and many other areas. He has also consulted for research organizations, government agencies, and industrial companies in a variety of subjects ranging from LNG spills to spacecraft fire safety. Fernandez-Pello is currently a Professor of Mechanical Engineering at the University of California at Berkeley where he has been a faculty member since 1980.

## Work History

2008 – present **Reax Engineering, Partner**  
1986 – present **University of California, Berkeley** Dept. of Mechanical Engineering, *Professor*  
2003 – present **University of California, Berkeley** Graduate Division, *Associate Dean*  
1982 – 1986 **University of California, Berkeley** Dept. of Mechanical Engineering, *Associate Professor*  
1980 – 1982 **University of California, Berkeley** Dept. of Mechanical Engineering, *Assistant Professor*  
1980 – present **Freelance technical consultant for fire-related litigation and research**  
1980 – 1980 **Northwestern University** Dept. of Mechanical Engineering, *Associate Professor*  
1977 – 1980 **Princeton University** Dept. of Mechanical and Aerospace Engineering, *Research Staff Member*  
1975 – 1976 **Harvard University** Division of Engineering and Applied Physics, *Post-doctoral research fellow*

## Fire Litigation (Expert Witness) and Engineering Practice

Between 1980 and 2010, Dr. Fernandez-Pello has served as a consultant to private industry and government organizations for work related to combustion, fire, and explosions.

*Representative fire litigation/expert witness clients include:*

- **Beardsley, Jensen & Von Wald** (Rapid City, SD) – Wildland fire involving power lines (deposition)
- **Begs & Lane** (Pensacola, FL) – Fire and crash of a general aviation aircraft
- **Bishop, Barry, Howe, Haney & Ryder** (San Francisco, CA) – Explosion of liquid fuel (depo & testimony)
- **Burke & Bauermeister** (Anchorage, AK) – Structure fire involving large television (deposition)
- **Cozen & O'Connor** (Atlanta, GA) – Fire in a enamel drying industrial facility (deposition)
- **Cozen & O'Connor** (Philadelphia, PA) – Fire in an industrial oven facility (deposition)
- **Cozen & O'Connor** (Philadelphia, PA) – Industrial fire involving naphthalene (deposition)
- **Cozen & O'Connor** (Philadelphia, PA) – Electrical heater fire in warehouse (deposition & testimony)

- **Dale Sprik & Associates** (Grand Rapids, MI) – Residential fire originating in a kitchen (deposition)
- **Ernest M. Thayer** (Oakland, CA) – Automobile/structure fire (deposition & testimony)
- **Fetterly & Gordon** (Minneapolis, MN) – Rack storage fire in a paper recycling warehouse (deposition)
- **Fetterly & Gordon** (Minneapolis, MN) – Smoke detector product liability in structure fire (deposition)
- **Fowler et al.** (Miami, FL) – Crash and subsequent fire of a general aviation airplane (deposition)
- **Gordon & Rees** (San Francisco, CA) – Electrical transformer fire
- **Griffin & Laser** (Houston, TX) – Ignition of spilled solvent by water heater pilot
- **Haight Brown & Bonesteel** (Santa Ana, CA) – Residential fire involving ignition of a solvent (deposition)
- **Hallmark et al.** (Portland, OR) – General aviation airplane crash and fire
- **HellerEhrman** (San Francisco, CA) – Modeling of wildland fire involving power lines
- **Herrick, Hart, Duchemin, Spaeth, Sullivan & Schumacher** (Eau Claire, WI) – Tanker fire (deposition)
- **Hillsinger & Costenco** (San Diego, CA) – General aviation airplane fire (deposition)
- **Kirtland & Packard** (Los Angeles, CA) – Smolder initiated structure fire (deposition)
- **Knox et al.** (Oakland, CA) – Smolder initiated fire in a commercial building (deposition & testimony)
- **LA DWP** (Los Angeles, CA) – Office building fire involving transformer (deposition & testimony)
- **Laser, Proctor & Cole** (Houston, TX) – Oil well gas ignition and explosion (deposition)
- **Mackenroth, Ryan, Jacobson, Fong** (Sacramento, CA) – Fire in general aviation aircraft
- **Maloney & Smith** (Dallas, TX) – General aviation aircraft fire (deposition)
- **Martin** (Reno, NV) – Propane gas explosion and smolder initiated fire (deposition)
- **Martin, Ryan, & Andrada** (Oakland, CA) – Propane container explosion
- **Morgenstein & Jubelirer** (San Francisco, CA) – Residential fire involving a laptop
- **Morgenstein & Jubelirer** (San Francisco, CA) – Structure fire involving electrical heater (deposition)
- **Morris, Haynes & Hornsby** (Birmingham, AL) – Residential fire involving a gas heater (deposition)
- **Murchison & Cumming** (Los Angeles, CA) – Spontaneous ignition in coal loader (deposition & testimony)
- **Murchison & Cumming** (Los Angeles, CA) – Wildland fire involving power lines (deposition & testimony)
- **O'Melveny & Myers** (Los Angeles, CA) – Gasoline pipeline fire
- **O'Melveny & Myers** (Los Angeles, CA) – Spontaneous ignition of chemical product
- **Paine, Hamblen, Coffin, Brooke & Miller** (Spokane, WA) – Wildland fire
- **Pretzel & Stouffer** (Chicago, IL) – Fuel tanker truck fire (deposition)
- **Pretzel & Stouffer** (Chicago, IL) – Rack storage fire in a cold storage facility
- **Ronquillo & Orderica** (San Diego, CA) – Gasoline initiated structure fire (deposition & testimony)
- **San Diego Gas & Electric** (San Diego, CA) – Wildland fire (deposition & testimony)
- **Schwartz & Cera** (San Francisco, CA) – Hydrogen explosion in gas storage warehouse (deposition)
- **Shield & Smith** (Los Angeles, CA) – General aviation airplane fire
- **St. Clair, McFertridge, & Griffin** (San Francisco, CA) – Pier fire (deposition)
- **Subrogors Committee** (Las Vegas, NV) – Explosion in a rocket propellant plant

*Consulting for other institutions:*

- **National Institute of Standards and Technology, NIST** (Gaithersburg, MD)
- **National Aeronautics and Space Administration, NASA** (Cleveland, OH)
- **National Research Council, NRC** (Washington, DC)
- **Lawrence Livermore National Laboratories, LLNL** (Livermore, CA)
- **Sandia National Laboratories** (Albuquerque, NM)
- **Failure Analysis/Exponent** (Menlo Park, CA)
- **Fire Science Application** (San Carlos, CA)
- **Exxon** (Florham Park, NJ)
- **SENER** (Madrid, Spain)

## Research

*Tackling CFD Modeling of Flame Spread on Practical Solid Combustibles (NSF)*

- Project involves the development of a generalized pyrolysis model that can simulate the pyrolysis and burning of real-world materials encountered in fires
- The computer model is coupled to an existing CFD code and used to calculate flame spread on real-world solid combustibles over a range of length scales.

*Smoldering Combustion and its Transition to Flaming in Microgravity (NASA Space Flight Program)*

- Research concerns smoldering and the transition to flaming of foams, composite, and cellulosic materials
- Experimental studies performed at normal gravity and in reduced gravity in the Space Shuttle

*Test Method for Materials Flammability in Microgravity (NASA Space Flight Program)*

- Work leading to the development of a new test method for the fire properties of materials used in aircraft and spacecraft
- The test is based on the piloted ignition (hot spot or spark) of materials exposed to external heating

*Carbon Monoxide and Soot Formation in Inverse Diffusion Flames (NASA Ground Based Program)*

- Experimental study of CO and soot production in inverse diffusion flames (special case of underventilated combustion)
- Results will improve understanding of the formation of these products during underventilated fires in earth and spacecraft

*Ignition, Flame Spread and Extinction in Solid and Liquid Fuels (NIST/NSF)*

- Research on the initiation and spread of flames over solid and liquid fuels
- Includes studies of fuel ignition, the subsequent spread of flames and steady burning, and flame extinction

*Transport and Combustion of Embers and Metal Particles in Wild-land Fires (Various)*

- Objective is to model the trajectory of embers and burning metal particles generated in wildland fires to predict fire spotting
- Results of the project could help predict wildland fire development to help fire fighters to direct fire efforts in wild-land fires
- Results could also protect the life of firefighters that are often caught in the middle of two propagating fires due to fire spotting by flying embers

*Rotary Internal Combustion Micro-Engine (DARPA/MEMS)*

- Develop a portable small-scale rotary internal combustion micro-engine would be capable of delivering power using liquid fuels.
- Because liquid fuels have a much higher power density than batteries, the project aims at the replacements of batteries in cases where weight is critical.
- Potential applications include propulsion of small devices and portable power generation.

*Liquid Fuel Spray Ignition (ARO/TACOM)*

- Studies of the mechanisms of ignition and burning of liquid fuel droplets and sprays under supercritical conditions for diesel engines applications.

*Liquid Fuel Pool Fires and Boilover Burning of Fuels Spilled on Water (CNR/France)*

- Collaboration with ENSMA, Poitiers, France to study the boilover burning of heavy hydrocarbon fuels (diesel oil, heating oil, etc.) spilled on water

## **PhD Dissertation and MS Thesis Advising**

- Chaired 24 PhD dissertations and 51 MS Theses in UC Berkeley Department of Mechanical Engineering

## **Publications**

Over 160 refereed archival publications in technical journals in the fields of combustion, fire, and heat transfer. Four book chapters. Over 200 other publications. Selected publications:

1. Alvares, N.J., Fernandez-Pello, A.C., Hasegawa, H., Hout, K., and White, J., "Analysis of a Run Away High Rack Storage Fire," NFPA Fall Meeting, Dallas, TX, November 1992.
2. Fernandez-Pello, A.C., "The Challenge of Fire Prediction," *Combustion Science and Technology, Special Silver Anniversary Issue, The Next 25 Years* **98**: 281-290 (1994).

3. Cordova, J., August, M., and Fernandez-Pello, A.C., "Auto-ignition of a Flat Solid Fuel in a High Temperature, Oxidizing, Boundary Layer Flow," *Combustion Science and Technology* **113-114**: 573-595 (1996).
4. Tse, S.D., and Fernandez-Pello, A.C., "On the Flight Paths of Metal Particles and Embers Generated by Power Lines in High Winds and Their Potential To Initiate Wildland Fires," *Fire Safety Journal* **30**: 333-356 (1998).
5. Alvares, N. and Fernandez-Pello, A.C., "Fire Initiation and Spread in Overloaded Communication System Cable Trays," *Experimental Thermal and Fluid Science* **21**: 51-57 (2000).
6. Anthenien, R.A., Walther, D.C., and Fernandez-Pello, A.C., "Smolder Ignition of Polyurethane Foam: Effect of Oxygen Concentration," *Fire Safety Journal* **34**: 343-359 (2000).
7. Cordova, J.L., Torero, J.L., Walther, D.C., and Fernandez-Pello, A.C., "Oxidizer Flow Effects on the Flammability of Solid Combustible Materials," *Combustion Science and Technology* **164**: 253-278 (2001).
8. Stevanovic, A., Mehta, S., Zhou, Y.Y., Walther, D., and Fernandez-Pello, A.C., "Effect of Fiberglass Concentration on the Piloted Ignition Delay of Polypropylene Fiberglass Composites," *Combustion Science and Technology* **174**: 169-185 (2002).
9. Alvares, N. and Fernandez-Pello, A.C., "A Methodology to Determine Pre-crash Fuel Quantity from Post-crash Fire Thermal Damage to Aircraft Structure," *Fire and Explosion Hazards: Proceedings of the 4<sup>th</sup> International Seminar*, University Press, pp. 847-856 (2004).
10. Fernandez-Pello, A.C., Rein, G., Bar-Ilan, A., and Alvares, N., "Estimating the Performance of Enclosure Fire Models by Correlating Forensic Evidence of Accidental Fires" *Interflam 2004*, pp. 1183-1194 (2004).
11. Lautenberger, C., Zhou, Y.Y., and Fernandez-Pello, A.C., "Numerical Modeling of Convective Effects on the Piloted Ignition of Composite Materials," *Combustion Science and Technology* **77**: 1231-1252 (2005).
12. Putzeys, O., Fernandez-Pello, A.C., and Urban, D.L., "Ignition of Combustion Modified Polyurethane Foam," *Journal of ASTM International* **3**: 13558 (2006).
13. Anthenien, R., Tse, S., and Fernandez-Pello, A.C., "On the Trajectories of Embers Initially Elevated or Lofted by Ground Fire Plumes in High Winds," *Fire Safety Journal* **41**: 349-363 (2006).
14. Rein, G., Bar-Ilan, A., Fernandez-Pello, A.C., and Alvares, N., "A Comparison of Three Fire Models in the Simulation of Accidental Fires," *Journal of Fire Protection Engineering* **16**: 183-209 (2006).
15. Lautenberger, C., Torero, J.L., and Fernandez-Pello, A.C., "Understanding Material Flammability," in *Flammability Testing of Materials in Building, Construction, Transport and Mining Sectors*, Ed. V. Apte, Woodhead Publishing, pp. 1-21, (2006).
16. Sardoy, J., Consalvi, J., Porterie, B., Loraud, J., and Fernandez-Pello, A.C., "Modeling Transport and Combustion of Firebrands from Burning Trees," *Combustion and Flame* **150**: 151-169 (2007).
17. Lautenberger, C. and Fernandez-Pello, A.C., "Modeling Ignition of Combustible Fuel Beds by Embers and Heated Particles," *Forest Fires 2008* (2008).
18. Nmira, F., Consalvi, J.-L., Kaiss, A., Porterie, B., and Fernandez-Pello, A.C., "A Numerical Study of Water Mist Mitigation of Tunnel Fires," *Fire Safety Journal* **44**: 198-211 (2009).
19. Lautenberger, C. and Fernandez-Pello, C., "A Model for the Oxidative Pyrolysis of Wood," *Combustion and Flame* **156**: 1503-1513 (2009).
20. Scott, S., Hadden, R., Fereres, S., Lautenberger, C., and Fernandez-Pello, A.C., "Ignition of Combustible Fuel Beds by Embers and Heated Particles," 2009 Fall Technical Meeting, Western States Section/Combustion Institute, U.C. Irvine, CA, October 26-27, paper 09F-26, 2009.

### **Honors, Scholarships, and Fellowships**

- ASME Fellow
- Member of The Royal Academy of Engineering of Spain
- Best Paper Award, Sixth Symposium of the International Association of Fire Safety Science
- Pi Tau Sigma Award for Excellence in Teaching
- Fellowships from Fullbright Foundation, Juan March Foundation, the Japan Society for the Promotion of Science and MITI, Japan, the French and Italian CNR

### **Editorial Advisory Board**

- *Combustion Science and Technology* (1992-present), *Progress in Energy and Combustion Science* (1995-2006), *Combustion and Flame* (1994-2001)