

PROFESSIONAL RESUME
R. FRANK CHIAPPETTA, BSc., MSc.
BLASTING ANALYSIS INTERNATIONAL, INC.

WORK EXPERIENCE

1988 to Present **Blasting Analysis International, Inc., Allentown, PA**

Position: President and Explosives Application Engineer

Duties - International Blasting Consultant to a number of mining, explosives and related companies in all 50 States and 26 other countries.

Areas of Expertise:

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|---------------------------------------|---------------------------------|
| - Blast consulting and monitoring | - Structural damage inspections |
| - Ground vibration/airblast controls | - Close-in blast designs |
| - Technical safety audits/arbitration | - Accident Investigations |
| - Explosives applications | - Training (worldwide) |

1981 - 1988 **Atlas Powder Company, Tamaqua, PA**

Positions held:

1. Assistant Director of Field Technical Operations, 1988
2. Manager of Field Research, 1986 - 1987
3. Technical Specialist, 1984 - 1985
4. Technical Representative, 1981 - 1983

Duties - Blast design, blast monitoring and diagnostics, field instrumentation, explosive applications, computer modeling, detonator studies, monitoring ground vibrations and airblasts for potential damage to residential and commercial structures, training and developing new and more efficient blast designs for surface and underground operations.

1980 - 1981 **Queen's University, Kingston, Ontario, Canada**

Position: Research Assistant and Laboratory Instructor

Duties - Teaching and demonstrating the safe handling, storage, haulage and use of explosives to undergraduate students.

Set up laboratory for full scale experiments to study explosive characteristics, explosive performance, presplitting techniques for highwall and slope stability control, monitoring ground vibration/airblast and their effects on structures.

Taught data reduction, analytical techniques and data interpretation in relation to full scale blast designs to undergraduate students.

1979 - 1981

Iron Ore Company of Canada, Labrador City, Newfoundland, Canada

Position: Consulting Research Engineer

Duties - Responsible for setting up and supervising ground vibration monitoring stations in a haulage tunnel located underneath the open pit mine. This involved close-in blasting where the distance between the roof of the haulage tunnel and large surface blasts was approximately 90 feet. Responsible for data interpretation and blast design recommendations for all blasts to reduce damage potential to the tunnel.

Also responsible for testing explosive accessories, detonators, and to set up a high-speed photography program for evaluating blast performance. Assisted with recommendations in all pit areas regarding blast designs.

1971 - 1977

INCO Metals, Inc., Sudbury, Ontario, Canada

Positions: Contract Miner, Stope Leader, Level Boss

Duties - Drilling and blasting in tunneling, stoping, development headings and chutes. Assisted in the mine's ground control program where discontinuities were monitored in critical sections of the mine after large blasts. Also worked in all types of underground mining methods and explosive applications.

CURRENTLY SERVING OR SERVED AS PRINCIPAL BLASTING CONSULTANT TO:

1. Panama Canal Commission, Panama
 - Widening of the Panama Canal project
 - Custom blast designs & explosives specifications in widening of the canal
 - Explosives hazard assessments, safety training and application
 - Presplitting, highwall and slope failure control
 - Ground vibration, airblast, flyrock, dust and fumes control
2. The Whiting-Turner Contracting Company, USA
 - Assisted with blast plan preparations for Warrior Transition Unit
 - Supervised all close-in blasting operations for compliance
 - Reviewed vibration and airblast results
3. Iron Ore Company of Canada, Canada
 - Blast impact study on primary crusher
 - Fragmentation studies
 - Close-in blast designs next to the ore barn
4. Newberg, Rogers, Walker, USA
 - Blast designs and seismic monitoring for the New Lehigh Tunnel No. 2 Project (Pennsylvania Turnpike Commission)

5. Marathon Petroleum Company, USA
 - Drilling and blasting audits in underground cavern
 - Hazard assessments
 - Advised on OSHA regulations for compliance
 - Provided blast design advice to subcontractors
6. BHP Billiton, Australia, South Africa and Chile
 - Hot hole loading procedures
 - Overburden casting
 - Vibration/airblast controls
7. Rogers Group, USA
 - Consults for over 50 quarries in Kentucky, Indiana, Illinois, Alabama, Tennessee and Arkansas.
 - Technical drilling and blasting audits
 - Recommends blast design changes
8. Liberty Mutual Insurance, USA
 - Blast Damage Inspections for residential and commercial structures
9. EXSA, Peru
 - Surface and underground technical training
 - Presplitting and highwall controls
 - Explosives testing
10. Shanduka Coal Company, South Africa
 - Vibration/Airblast Controls
 - Drilling and blasting audits
11. Heinke, Luders y Carr, Chile
 - Underground tunneling and ring blast designs
 - Tunneling overbreak controls
12. Florida Rock Quarries (USA)
 - Vibration/airblast controls to minimize complaints
 - Blast designs for fragmentation and highwall controls
13. INGWE Coal Corporation, South Africa
 - Blasting efficiencies, technical audits, training and accident investigations
 - Vibration/airblast controls
14. CYPRUS/AMAX Coal Company, USA
 - Blast casting, ground vibration studies and air deck applications
15. Samancor, South Africa
 - Blast diagnostics, troubleshooting and custom blast designs

16. SASOL/SMX Explosives, South Africa
 - Explosives, mining applications and training
 - Methods of reducing ground vibrations/airblast
 - Blast damage inspections
17. INTERCOR, Colombia
 - Technical/safety audits, training and custom blast designs for steeply dipping coal seams
 - Blast designs and procedures for loading hot holes
18. International Technologies (Worldwide)
 - Developing new blasting techniques using electronic detonators in conjunction with airdecks
19. Richards Bay Minerals, South Africa
 - Safe blasting techniques in dredging operations and maintaining integrity of highwalls
20. Orica, Chile, Mexico and Peru
 - Drilling and blasting audits, and training
 - Blast designs for highwall controls in large open pit mines
 - Overbreak controls
21. Thiokol Corporation, USA
 - Electronic detonator applications and training
 - Vibration/airblast controls
22. MSI - Mining Services International, USA
 - Provided backup technical services for their clientele
23. U.S. Army Corps of Engineers, USA
 - Dimension/armor stone damage and presplitting studies
24. U.S. Army, Picatinny Arsenal, USA
 - Tactical explosives system development, testing and explosives evaluations

ADDITIONAL PROFESSIONAL ACTIVITIES

International Society of Rock Mechanics

Working group member on developing standards for blast monitoring instrumentation and analytical techniques.

Comprehensive Test Ban Treaty (CTBT)

Active member of industry working group developing methods of reducing the seismic visibility of mining to regional monitoring stations and verifying nuclear versus legitimate mining blasts.

ISRM Commission on Fragmentation by Blasting

General Manager of the International organizing committee. Assists in conference organization, reviewing technical papers and workshop training.

Massachusetts Institute of Technology

From 1985 to 1990, participated in an annual summer course at MIT, teaching industry, military and consulting firms on methods of blast evaluations, diagnostics and blast designs. This was accomplished with the use of modern, analytical field and laboratory test equipment. Data collected is reduced, analyzed and interpreted in terms of improving blast design efficiency and reducing ground vibrations and flyrock.

BME - Bulk Mining Explosives

From 1990 to 2009, has participated in an annual "Southern African Surface Mining Seminar" in teaching, "Methods of Designing Custom Blast Designs, Blast Monitoring Equipment, Field Controls and Vibration/Airblast Controls."

University, College Lecturer and/or Invited Speaker

Provided lectures, seminars and blasting courses at the following educational institutions:

- Cambrian College of Applied Arts and Technology (Canada)
- Institute of Quarrying (Brazil)
- Leoben University (Austria)
- Queen's University (Canada)
- Massachusetts Institute of Technology (USA)
- McGill University (Canada)
- New Mexico Tech (USA)
- Polytechnical Institute of Mining (Italy)
- Technical University of Vienna (Austria)
- University of Chihuahua (Mexico)
- University of La Serena (Chile)
- WITS University (South Africa)

United States Bureau of Mines

Was an outside technical review authority for the United States Bureau of Mines (USBM) on select papers and publications. Such papers include, "Residential Structure Response From Blast Induced Ground Vibrations", "Results of Accurate Detonators on Fragmentation", "Fragment Size Distribution Assessment Using a Digital Image Based Measurement System", "Effects of Surface Mine Blasting Near Pressurized Buried Pipelines", and "Frequency Analysis of Blast Data".

Industry Training Seminars

Within the last 23 years, has lectured and conducted a multitude of seminars to many organizations around the world. A sampling of seminar subjects are listed as follows:

- Methods of controlling flyrock, ground vibrations, airblast, dust and noxious fumes
- Close-in blasting applications
- Mine to Mill optimization
- Hot hole loading procedures
- Blast permitting applications and concerns
- Blast designs to minimize highwall damage failures
- Underground mining methods and tunnel blast designs
- Causes and solutions to control coal damage
- Custom blast designs
- Troubleshooting
- Fragmentation and joint structure analysis
- Blast instrumentation
- High-speed photography as a tool for use in blast design
- Measuring velocity of detonations
- Computer modeling of blasts
- Sympathetic Detonations
- Fragmentation Controls for oversize and fines
- Seismic data interpretation
- Overburden casting
- Quarry blasting
- Crater applications
- Ditching
- Safe use and handling of explosives, pyrotechnics and energetic materials
- Alternate velocity loading techniques
- Detonator timing and reliability studies
- Drilling and blasting economics
- Air deck technology
- Precise timing applications
- Blast designs of the future.

State-of-the-Art Blasting Technology, Instrumentation and Explosives Applications Seminar

Between 1989 and 2000, has coordinated annual international training courses on the latest blasting technology, instrumentation, applications and safety issues. (Held in Orlando, New Orleans, Boston, San Diego and Nashville, USA.)

Memberships

- International Society of Explosives Engineers (ISEE)
- Canadian Institute of Mining and Metallurgy (CIM)
- International Society of Rock Mechanics (ISRM)

ACADEMIC QUALIFICATIONS

- 1980 - 1982 Masters Degree (MSc) – Mining Engineering
(Specialized in Explosives Applications and Seismic/Airblast Waves)
Queen's University, Kingston, Ontario, Canada
- MSc Thesis - "An Evaluation of Seismic Instrumentation as Applied to a Loose
Detection System and Tension Testing of Roof Bolts"**
- 1977 - 1980 Bachelor of Science (BSc) – Mining Engineering
(Specialized in Explosives Applications)
Queen's University, Kingston, Ontario, Canada
- BSc Thesis - "Application of High-Speed Photography in Testing Conventional and
Hand Made Surface Delays, In-the-Hole Delays, Square Knots and Blast Analysis"**
- 1975 - 1977 Mining Technology Diploma (MNTY) - GPA = 4.0
Cambrian College of Applied Arts & Technology
Sudbury, Ontario, Canada
- 1965 - 1969 Grade 13 High School Diploma
5 Year Science and Technology Program
Western Technical and Commercial School, Toronto, Ontario, Canada

AWARDS

- 1990 Received the **International Society of Explosives Engineer's Prestige Service Award** for
outstanding technical service and diagnostic techniques developed for improving blast designs in
the mining and explosives industries. This is the society's highest award.

PUBLISHED BOOKS

1995 - 1998, External reviewer for recently published textbook by the International Society of
Explosives Engineers, entitled "Blasters Handbook", 17th Edition.

In 1987, was one of four major authors of the textbook entitled "Explosives and Rock Blasting". Wrote
Chapter 7 on Blasting Theory and Chapter 11 on Ground Vibration and Airblast. Also co-authored
Chapter 2 - Explosives Properties, Chapter 8 - Principles of Priming, Chapter 10 - Surface Blast Design
and Chapter 14 - Construction.

PUBLISHED TECHNICAL PAPERS AND/OR PRESENTATIONS

- 2011 Chiappetta, R.F., **Presplitting Guidelines which Guarantee Results in Medium to Large Diameter Holes.** Pennsylvania Drilling and Blasting Conference, Penn State University, State College, PA, November, 2011.
- 2010 Chiappetta, R.F., **Safe Loading in Hot Holes.** IQPC Drill & Blast Conference, Perth, Australia, October 2010, and Kentucky Blasting Conference, Lexington, KY, December, 2010.
- 2010 Chiappetta, R.F., **Dealing with Oversize in the Collar Zone, While Controlling Flyrock and Airblast.** Kentucky Blasting Conference, Lexington, KY, December, 2010.
- 2010 Chiappetta, R.F., **Presplitting and Highwall Controls.** IQPC Drill and Blast 2010 Conferences. Brisbane, Australia, April 2010 and Perth Australia, October, 2010.
- 2010 Chiappetta, R.F., **Optimizing Fragmentation with Electronic Detonators, Stem Charges and Air Deck.** IQPC Drill and Blast 2010 Conferences. Brisbane, Australia, April 2010 and Perth Australia, October, 2010.
- 2009 Chiappetta, R.F., **Combining Electronic Detonators with Stem Charges and Air decks.** Fragblast 9 Conference, Granada, Spain, September, 2009.
- 2008 Chiappetta, R.F., **Underground Mining and Tunnel Blasting Methods.** University of Chihuahua, Chihuahua, Mexico, February, 2008.
- 2007 Chiappetta, R.F., **Controlling Ground Vibrations and Improving Fragmentation with Electronic Detonators, Stem Charges and Air Decks.** BME Surface Blasting Conference, Pretoria, South Africa, October, 2007.
- 2006 Chiappetta, R.F., **Explosive Properties.** Presented at Vibra-Tech Engineers Training Seminar, Florida, January, 2006.
- 2006 Chiappetta, R.F., **How to Reduce Oversize in the Collar Zone, while Controlling Ground Vibrations, Airblast, Dust and Noxious Fumes.** Presented at Vibra-Tech Engineers Training Seminar, Florida, January, 2006.
- 2004 Chiappetta, R.F., **A Detailed Case History Investigation of Two Blasting Fatalities.** Presented at the Blasters Refresher Training Course, April 2004 for the West Virginia Department of Environmental Protection.
- 2004 Chiappetta, R.F., **New Blasting Technique to Eliminate Subgrade Drilling, Improve Fragmentation, Reduce Explosive Consumption and Lower Ground Vibrations,** Proceedings, International Society of Explosives Engineers 30th Conference on Explosives and Blasting Techniques, New Orleans, USA Feb. 1 - 4, 2004.
- 2001 Chiappetta, R.F., van Vreden, A, **How to Deal Effectively with Vibration/Airblast Complaints,** Quarry Institute Conference, Johannesburg, South Africa, March 2001.
- 2000 Chiappetta, R.F., van Vreden, A, **Vibration/Airblast Controls, Damage Criteria, Record Keeping and Dealing with Complaints,** BME Surface Blasting Course, Johannesburg, South Africa, October, 2000.

- 1999 Chiappetta, R.F., **The Need for Site-Specific, Safe Ground Vibration/Airblast Damage Criteria**, Institute of Quarrying, Durban, South Africa, March 1999.
- 1999 Chiappetta, R.F., **Presplitting Techniques for Underground/Surface, Highwall and Slope Failure Controls**, EXTAMIN 99 Conference, Peru
- 1998 Chiappetta, R.F., **Blast Monitoring Instrumentation and Analysis Techniques, with an Emphasis on Field Applications**, FragBlast Journal, 1998.
- 1998 Palangio, T., Chiappetta, R.F., Burrow, K., **Jointing and Fragmentation Analysis for Blasting and Processing Facilities**, South African Institute of Quarrying, Durban, South Africa, April 12 - 14, 1998.
- 1998 Chiappetta, R.F., **Factors Affecting Fragmentation**, SMX Explosives Training Course, Secunda, South Africa, April 24 - 25, 1998.
- 1998 Chiappetta, R.F., Treleven, T., Nixon, E., Smith, J.D., **Expansion of the Panama Canal**, Proceedings, Society of Explosives Engineers 24th Annual Conference on Explosives and Blasting Techniques, Louisiana, USA, February 1998.
- 1997 Chiappetta, R.F., **Workshop on Continuous Velocity of Detonation Systems**, Proceedings, State-of-the-Art Blasting Technology, Instrumentation and Explosives Applications, Orlando, Florida, USA, July 1997.
- 1995 Chiappetta, R.F., **Methods of Evaluating Fragmentation**, Kentucky Blasting Conference, Lexington, Kentucky, USA, December 1995.
- 1995 Chiappetta, R.F., Postupack, C., **An Update on Causes and Recommendations in Controlling Coal Damage**, Proceedings, EXPLO95, Brisbane, Australia, Sept. 1995.
- 1993 Chiappetta, R.F., **Continuous Velocity of Detonation Measurements in Full Scale Blast Environments**, Proceedings, Innovative Mine Design for the 21st Century, Queens University, Canada
- 1993 Chiappetta, R.F., **Workshop on State-of-the-Art Blast Analysis Techniques**, Seminar Proceedings, Technical University of Vienna, Austria
- 1992 Chiappetta, R.F., **Detonation Properties in Full Scale Blast Environments and How They Affect Results**, NIXT Conference Proceedings, Johannesburg, South Africa, October 14-16, 1992
- 1991 Chiappetta, R.F., **Methods of Evaluating Explosive Efficiency**, Seminar Proceedings, Fourth High-Tech Seminar on State-of-the-Art Blasting Technology, Instrumentation and Explosives Applications, Nashville, Tennessee, USA, June 1992.
- 1992 Chiappetta, R.F., **Precision Detonators and Their Applications in Improving Fragmentation, Reducing Ground Vibrations and Increasing Reliability - A Look Into the Future**, Seminar Proceedings, Fourth High-Tech Seminar on State-of-the-Art Blasting Technology, Instrumentation and Explosives Applications, Nashville, Tennessee, USA, June 1992.
- 1992 Chiappetta, R.F., **Site and Explosives Characterizations Using State-of-the-Art Blast Monitoring Instrumentation Systems**, Proceedings, CIM - 94th Annual General Meeting, Montreal, Quebec, Canada, April 1992.

- 1991 Chiappetta, R.F., **Generating Site Specific Blast Designs with State-of-the-Art Blast Monitoring Instrumentation and PC Based Analytical Techniques**, Proceedings, Society of Explosives Engineers 17th Annual Conference on Explosives and Blasting Techniques, Las Vegas, Nevada, USA, February 1991.
- 1991 Chiappetta, R.F., **Practical Methods of Controlling and Reducing Ground Vibrations and Airblast Levels**, Northwest Mining Association Short Course, Spokane, Washington, December 1-3, 1991.
- 1990 Chiappetta, R.F., Srihari, H.N., Worsley, Paul, N., **Design of Overburden Casting by Blasting - Recent Developments**, Proceedings of Drilling and Blasting in Surface Mines, Journal of Mines, Metals and Fuels, India.
- 1990 Chiappetta, R.F.; Vandenberg, B., **Workshop on Using High-Speed Motion Picture Photography for Blast Analysis, Evaluation and Design**, Seminar Proceedings, Second High-Tech Seminar on State-of-the-Art Blasting Technology, Instrumentation and Explosives Applications, Orlando, Florida, USA, 154 pp.
- 1990 Chiappetta, R.F.; Vandenberg, B., **High-Speed Motion Picture Photography Analysis in 3D - A New Approach to Analyzing Full Scale Blasts**, Proceedings, Third International Symposium on Rock Fragmentation by Blasting, Brisbane, Australia.
- 1990 Chiappetta, R.F.; Vandenberg, B., **Interpreting Continuous Velocity of Detonation Measurements**, Seminar Proceedings, Second High-Tech Seminar on State-of-the-Art Blasting Technology, Instrumentation and Explosives Applications, Orlando, Florida, June 1990.
- 1990 Chiappetta, R.F.; **Presplitting and Controlled Blasting Techniques**, Proceedings, Second High-Tech Seminar on State-of-the-Art Blasting Technology, Instrumentation and Explosives Applications, Orlando, Florida, June 1990.
- 1990 Chiappetta, R.F., **Generating Site Specific Blast Designs Using Modern Blast Instrumentation Systems**, Proceedings, Blasting Techniques, Department of Mines and Metallurgy and the Society of Explosives of Quebec (SEEQ) in collaboration with the Quebec department of Transportation, Laval University, Quebec City, Quebec, Canada.
- 1988 Chiappetta, R. Frank; Mammele, Mark E.; Postupack, C., **Causes and Recommendations for Controlling Coal Damage when Blasting Overburden**,
a) Proceedings of the American Mining Congress, April 24-29, 1988, Chicago, IL., USA.
b) Society of Explosives Engineers, Proceeding of the Fourteenth Annual Conference on Drilling and Blasting Techniques, February 1-5, 1988, Anaheim, CA, USA .
- 1988 Chiappetta, R. Frank; Mammele, Mark E., **Blasting Analysis and Design Using High-Speed Photography**, (Part III) Proceedings, Society of Mining Engineers Conference, January 25-29, 1988, Phoenix, AZ, USA.
- 1987 Chiappetta, R. Frank; Mammele, Mark E., **Analytical High-Speed Photography to Evaluate Air Decks, Stemming Retention and Gas Confinement in Presplitting, Reclamation and Gross Motion Application**, Proceedings, Second International Symposium on Rock Fragmentation by Blasting, August 23-28, 1987, Keystone, CO, USA.

- 1987 Chiappetta, R. Frank; Mammele, Mark E., **Blast Evaluations and Designs Using High-Speed Photography, (Part II)**, Proceedings, International Society for Optical Engineering, August 16-21, 1987, San Diego, CA, USA.
- 1987 Chiappetta, R. Frank, **Modern Techniques and Instrumentation for Blast Analysis and Design**, California Mining Association, May 15-16, 1987, Victorville, CA, USA.
- 1986 Chiappetta, R. Frank, **Analytical Techniques to Evaluate Detonation Phenomena and Gross Motion in Full Scale Blasts**, Proceedings, Fragmentation, Form and Flow in Fractured Media, January 6-9, 1986, Neve Ilan, Israel.
- 1985/1986 Chiappetta, R. Frank, **Alternate Velocity Loading Techniques and Detonations in a Production Environment**,
 a) Fifth Annual Mine Safety and Application Seminar, United States Department of Labor, Mine Safety and Health Administration, National Mine Health and Safety Academy, January 22-23, 1986.
 b) Twelfth Annual Kentucky Blasting Conference, December 5-6, 1985, Lexington, KY, USA.
 c) Proceedings, Second Penn State University Blasting Conference, November 14-15, 1985, University Park, PA, USA.
- 1986 Chiappetta, R. Frank; Burchell, S.L.; Reil, J.W.; Anderson, D.A., **Effects of Accurate MS Delays on Productivity, Energy Consumption at the Primary Crusher, Oversize, Ground Vibrations and Airblasts**, Proceedings, Society of Explosives Engineers, Twelfth Annual Conference on Explosives and Blasting Techniques, February, 1986, Atlanta, GA, USA.
- 1983 Chiappetta, R. Frank; Borg D., **Increasing Blast Productivity Through Field Controls and High-Speed Photography**, Proceedings, First International Symposium on Rock Fragmentation by Blasting, August 22-26, 1983, Lulea, Sweden.
- 1983 Chiappetta, R. Frank; Bauer, A.; Dailey, P.; Burchell, S., **Use of High-Speed Motion Picture Photography in Blast Evaluation and Design (Part I)**
 a) Proceedings, Society of Explosive Engineers, Ninth Annual Conference on Explosive and Blasting Techniques, February, 1983, Dallas, TX, USA.
 b) Republished by World Mining Equipment Trade Journal, November, 1983.

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