# Qualifications



Test

UC San Diego Partnership

## Build

Manufacturing Construction Logistics

## Protective Technologies

Thought Leaders. Partners. Implementers.



#### Testing and Validation

#### 1.) Protective Technologies Group – Blast Simulator Tests of Sure-Board Series 200B Wall System (2011)

- Completed under direction and engineering expertise of PTG (forerunner of Protective Technologies, LLC)
- b. Series of UCSD (University of California San Diego) Blast
  Simulator tests conducted to determine the effectiveness of the advanced stud wall system to resist a variety of impulsive, blast-like loadings. Various stud spacings, connection types, and other details were compared to determine the optimal system.





#### 2.) HWH Protective Structures / Protective Technologies - Live Explosive Field Testing of Blast-resistant Modules using Harper Wall System Technology (May 2013)

- a. Third-party tested by Applied Research Associates (ARA)
- b. The structures were subjected to a 9,000 lb ANFO blast at a stand off of 150 ft which induced a peak reflected pressure as high as 63 psi and reflected impulse of 320 psi-ms. The results led to a "Low" level of response (highest level of blast resistance) for the BRM units.
- c. Optimal configuration resisted 3 consecutive blasts which included metal shrapnel with estimated impact velocities greater than 1,700 ft/s
- d. Test results were used to validate computational models for BRM resistance to vapor cloud explosion events



#### 3.) Tornado/Hurricane FEMA 361/320 Certifications for Harper Wall System

- a. Third-party tested and certified by Architectural Testing
- b. Live projectile testing passed for highest level of tornado/hurricane resistance
- c. Pressure chamber testing passed for highest level of tornado/hurricane





## **Test Results:**

#### Vapor Cloud Explosions (model):

35 psi, 1,179 psi-msec, 200 ms duration

#### **AT/FP or HE Explosions:**

63 psi, 320 psi-msec, 18 ms duration

#### Fire:

I-hr & 2-hr, evaluation in accordance with ASTM E-I 19-08

#### Seismic:

Exceeds 2009/2012 IBC, evaluation in accordance with EC 003-2012

#### **Sound Protection:**

Minimum volume requirements are met at 80 Hz and above, in accordance with ASTM E 413-04  $\,$ 

#### **Ballistics/Projectiles:**

Certified UL 752 Level 8 includes: Shotgun, 7.62mm, .44 mag, 9mm FMJ

#### Wind:

Minimum 250mph wind tolerance, exceeds 2009/2012 IBC, evaluation in accordance with EC 003-2012 Forced Entry: 15 minute/60 minute in accordance with US Department of State Guidelines

Comparison Chart							
Туре	Peak Reflected Pressure (psi)	Impulse (psi-msec)	Duration (msec)	Response Criteria	Residual Surface Deflection (in)	Ballistic Protection	Construction Materials
BRM (HE <sup>1</sup> )	63	346	18	Low <sup>3</sup>	0.20	Up to .50 cal	Composite
BRM (VCE <sup>2</sup> )	35	1,179	200	Low <sup>3</sup>	0.29	Up to .50 cal	Composite
Competition	18 to 20	Unknown	200	Medium <sup>4</sup>	Unknown	Up to 7.62mm	Steel

<sup>1</sup> HE or high explosive also refers to AT/FP (anti-terrorism force-protection) level blast events which are char acterized by having shorter loading durations, higher peak pressure and a smaller fireball

- <sup>2</sup> VCE or vapor cloud explosions are characterized by longer loading durations, lower peak pressure with larger and a longer lasting fireball
- <sup>3</sup> ASCE defines low damage response criteria as localized building/component damage. Building can be used; however repairs are required to restore integrity of structural envelope (there is no lower level).
- <sup>4</sup> ASCE defines medium damage response criteria as widespread building/component damage. Building cannot be used until repaired. Total cost of repairs is significant.
- <sup>5</sup> Price span is dictated by many factors, including layout, number of units, outfitting, MEP requirements, installation, shipping



### **Resumes of Key Personnel:**

#### Jordan Harper, President of Harrison, Walker & Harper

Jordan has more than fifteen years of management experience, and is responsible for strategic planning and leadership of all HWH companies, spanning site selection, construction, supply chain services and manufacturing. He has held key management roles covering all aspects of the construction business, and has led overall company operations since 2008, advancing to his current position in 2011. Earlier, he led the company's steel fabrication operations, and prior to that established a new storage and transportation business to leverage logistics expertise. Jordan received a B.B.S. Degree in Economics and Finance from Southern Methodist University, an M.B.A Degree from Texas A&M University-Commerce, and attended the Executive Program at the Harvard University School of Business. He is also a LEED Accredited Professional.

#### Brian Williams, MAJ EN, President of Protective Technologies, LLC / HWH Protective Structures

Brian is currently a Major, Engineer in the U.S. Army Reserve, and joined We Pack Logistics and the parent Harrison, Walker & Harper Companies (HWH) in 2012 to lead prototype projects as well as logistics and transload engagements. Shortly after arriving, he developed an XL Pipeline logistics rail site for the 120 mile East Texas Section of that project. He then helped establish and now also serves as President of two hazard mitigation/ specialty building systems operations that are part of the enterprise portfolio. HWH Protective Structures produces and markets a wall and anchoring system (patent applied for), and provides engineering and construction services. Protective Technologies LLC conducts related research, development and testing. Brian continues to lead strategic business initiatives for the HWH logistics and transload businesses, leveraging extensive civilian and military experience.

Prior to joining HWH, Brian managed lonode, LLC, the US operations of an Australia-based analytical sensor manufacturer. Earlier he started Forston Labs, an instrumentation company based in Colorado, following nine years with Analytical Sensors & Instruments (ASI), a firm supporting manufacturers in analytical industries with operations in the US and China, where he advanced to president and CEO after facilitating significant growth.

Brian was deployed to Afghanistan in 2008-09 with Combined Task Force Castle LOGCAP III/IV as Operations Plans Officer, and handled logistics and FOB construction for four Forward Operating Bases in RC East. He served as a Company Commander from 2001 to 2005, and was deployed to Iraq in 2003, where he constructed a 220-mile long aboveground fuel pipeline.

Brian earned a Bachelor of Science Degree from Steven F. Austin University and an MBA Degree from the University of Houston.



#### Allan Mangold, Principal of Protective Technologies, LLC / HWH Protective Structures

Allan has over 25 years experience in Accounting, Finance, Operations and Management and Business Development in industries ranging from insurance and surety, construction, construction finance, structural engineering and high technology. In 2001, Allan worked with University of California, San Diego as a technology partner in development of materials for seismic retrofit and blast mitigation. This effort led him to found Protective Technologies Group, Inc. (PTG), a consortium of a diverse group of companies that specialized in seismic, blast remediation and other hazards-mitigation technologies. PTG was the forerunner of Protective Technologies and HWH Protective Structures, of which he is a co-founder and principal.

#### Brad Durant, Senior Blast Engineer of Protective Technologies, LLC / HWH Protective Structures

Brad is the senior blast engineer for all hazard mitigation projects. He received a BS & MS Degree in Structural Engineering specializing in blast-resistant design and analysis from the University of California, San Diego. Brad received his master's degree under Dr. Gil Hegemier, with his graduate research including experimental shock loading and computational modeling for the Air Force Research Laboratory and Blast Simulator testing of advanced steel stud wall systems (a precursor of the BRM technology used by HWH Protective Structures). Brad also worked as a technician at the UCSD Englekirk Structural Engineering Center running the blast simulator and seismic simulator and as an intern at Karagozian and Case in Glendale, CA.

#### Gil Hegemier, Ph.D., PE, Consulting Chief Structural Engineer

Dr. Hegemier has over 30 years experience in field and laboratory blast and seismic testing, blast and seismic damage mitigation design, and computational analysis of structures subject to seismic and blast loading (These include conventional explosives, vapor cloud explosions, and nuclear events.). While at University of California, San Diego, Dr. Hegemier directed one of the largest blast mitigation programs in the U.S. This \$18.3M effort, funded by TSWG (Technical Support Working Group) of the CTTSO (Combating Terrorism Technical Support Office) concerned the development, through laboratory and field testing as well as high fidelity computational analysis, of protective technologies for critical U.S. infrastructure including buildings, bridges, tunnels, pipelines and other structural systems. In view of his expertise, Dr. Hegemier serves as a Subject Matter Expert on blast damage and security for a number of government and private entities. Examples include: Technical Support Working Group (TSWG), Department of Homeland Security (DHS), Transportation Security Administration (TSA), Port Authority of New York and New Jersey (PANYNJ), Lawrence Livermore National Laboratories (LLNL), Sandia National laboratories (SNL), and Science Applications International Corporation (SAIC). Dr. Hegemier also serves on forensic teams for blast events. Dr: Hegemier holds a PE in California.



#### Lauren Stewart, Ph.D., PE, Consulting Structural Engineer

Dr. Stewart is currently an Assistant Professor of Civil and Environmental Engineering at Georgia Institute of Technology. She earned her BS, MS & Ph.D. in Stuctural Engineering at the University of California, San Diego, under Dr. Hegemier. Dr. Stewart's Postdoctoral at UCSD involved the testing and design of blast mitigation systems for high explosion and vapor cloud explosion loads using blast resistant sheathing, characterization of shock environment on Fuze Systems for the Air Force Research Laboratory, and blast modeling and testing of the DDG1000 Deckhouse for the Office of Naval Research. Her work in blast resistant sheathing is the basis for HWH Protective Structures building system. Dr. Stewart's work includes World Trade Center 7 Impact Analysis, design of the Curtain Wall System for US Gypsum, Experimental Testing and Design of Tri-axial Pressure Vessel for ERDC, AT/FP design for Veterans Administration Data Center and design of the Blast Door for Munitions Storage facilities. Dr. Stewart holds a PE in California.

#### Christina Watson, PE, LEED AP BD+C, HWH Engineering Team Lead

Christina has over 15 years of experience as a structural engineer and a project manager, and leads the HWH engineering department. Her role includes developing structural designs, fabrication methods and constructability recommendations for hazard mitigation projects. Her experience includes the structural design of reinforced concrete, structural steel and prestressed concrete structures for commercial, industrial and institutional clients. Christina also served as an Army Engineer officer on active duty and in the Connecticut Army National Guard, where she commanded a Medium Girder Bridge company and deployed to Iraq as a technical advisor for infrastructure security. She received an MBA Degree from the University of Connecticut and a BS Degree in Civil Engineering from Worcester Polytechnic Institute. Christina is a licensed Professional Engineer in the states of Arkansas, Connecticut, Iowa, Kansas, Louisiana, Mississippi, Oklahoma, Pennsylvania, and Texas.

#### Greg Wilson, Ph.D., PE, HWH Senior Engineer

Dr.Wilson has consulted for HWH for over ten years, and joined the HWH team after retiring from university level teaching. Dr.Wilson was a tenured full professor with the University of Louisiana (Director for the School of Construction), Louisiana State University, assistant professor at the Texas A&M University Commerce Department of Industrial Engineering and an Adjunct at Southern Methodist University, University of Texas Arlington. Dr.Wilson's professional experience includes Halliburton, Ericsson, Professional Services Industries and MacTEC Engineering and Consulting. Dr.Wilson earned his BS in Construction Management from Arizona State University, MS in Civil Engineering (Geotechnical) from Arizona State University and his Ph.D. in Engineering (Geotechnical) from Arizona State University and his Ph.D. in Engineering (Geotechnical) from Arizona



#### Duane Good, PE, HWH Civil Engineer

Duane is a registered Professional Engineer with over 14 years of experience with the Texas Department of Transportation, focusing on design of bridges, roadways and pavement, as well as traffic control planning. He earned his Mathematics degree from Texas A&M University – Commerce. Duane is licensed in the state of Texas, and is a member of the Texas Society of Professional Engineers, the American Society of Civil Engineers, and the American Institute of Steel Construction.

#### Luke Vierus, HWH Mechanical Engineer

Luke Vierus has more than two years of experience, and previously served as a Project Engineer at Western International Gas and Cylinders, Inc. in Bellville, Texas. He has a Bachelor of Science degree in Mechanical Engineering from Texas A&M University. Luke specializes in a variety of fields, including process automation, process data analysis, process safety, project scheduling and project management.

#### Beatrice Ardila, HWH Architect

Beatrice is responsible for the preparation of construction documents including specifications and plans for the construction and/or alteration of buildings, and the selection of construction materials, waterproofing, and finishes. Beatrice is concurrently pursuing a Masters Degree in Architecture from Boston Architectural College and received her BS Degree in Architecture from the Universidad Nacional Experimental del Táchira in Venezuela. She has 10 years of experience as an architect working with firms such as Denney Architects in Paris and doing freelance architectural work in Venezuela.



#### **Protective Structures Completed Project Examples:**

#### BP Carson Building B-1065, Carson, CA.

The structure under consideration for upgrade was characterized by partially grouted CMU construction (circa 1970s) and was used by BP as an administration and control room (referred to as the South Area Processing building by BP).

Primary threats were vapor cloud explosion (19+ psi reflected pressure) and seismic (refinery is sited in an area defined as a high-risk seismic zone and very near the epicenter of the deadly 1933 Long Beach earthquake). Additionally, the structure was non-compliant with the updated City of Los Angeles/LA Department of Building and Safety (LADBS) seismic and structural codes, which are among the most stringent in the country.

BP required a complete retrofit for blast and seismic which would comply with API RP-752 guidelines for blast and fire, ASCE 7-05 guidelines for seismic, and the LADBS requirements for seismic and structural as per the Los Angeles Building Code (LABC). The LABC requirements supersede both the International Building Code (IBC) and the California Building Code (CBC), which presented a very complex engineering and design challenge, in that the design would be a blending of both blast and seismic engineering inside a mission critical structure for BP Carson's refinery operation. This building was in operation 24 hours a day, seven days a week and was on a 100% uptime schedule.

PTG presented a solution utilizing four layers of carbon-fiber-reinforced polymer (CFRP) which were applied inside the structure, with three layers in the vertical direction to absorb the blast load and one layer in the horizontal direction to provide shear resistance for a seismic event. BP thoroughly reviewed and then accepted the PTG design.



Point-of-Contact – Greg Jirak, 310.266.2156



#### ExxonMobil,Torrance, CA.

Protective Technologies Group (precursor of Protective Technologies) executed a blast design for retrofit and replacement of 8,000 windows at the ExxonMobil Refinery in Torrance, CA. As the blast threat varied at different locations along the building, a cost-effective approach was taken to tailor the robustness of the window upgrades in each wall region to match the design threat rather than utilize a "one size fits all" approach, which would lead to over-design of many components. The design included replacement of glazing and reinforcing/replacement of framing members and connections.

Point-of-Contact – Joe Salus: 281.834.3245





#### D.C. Cook Nuclear Generating Station, Bridgman, MI. Owned by American Electric Power

The Central Alarm Station was a single story, cast-in-place concrete structure which served as the primary early warning and defense system for the entire nuclear facility. Primary threats as per the governing standard, which is the Nuclear Regulatory Commission's (NRC) 10 CFR Part 73 physical security and protection guidelines, were explosive charges deployed against the roof of the structure (defined as Design Basis Threat #1) and the walls of the structure (defined as Design Basis Threat #2). Due to the classified nature of the project, we cannot provide charge weights for the threats in question, but can offer that both charges were sufficient to achieve what the NRC referred to as a "Building Kill," meaning the structure and attendant personnel would have been removed from operation.

PTG's solution for Design Basis Threat #1 involved repurposing an existing fence and frame system to create a "catcher system" capable of preventing the charge from touching the roof of the structure and providing sufficient standoff distance, in this case over 5', to prevent roof collapse and protect building personnel during the event of a detonation.

PTG's solution for Design Basis Threat #2 involved the engineering, design, and fabrication of a custom-made stainless steel clip system for the inside of the structure, placed at key load-bearing and joint connections. As with Design Basis Threat #1, the clip system ensured that, even in the event of a detonation, both personnel and the structure would be safe.

Lastly, it should be noted that the PTG solution, at \$700,000, saved the owner, American Electric Power, nearly \$1.2mm in total costs, including design and build costs.

Point-of-Contact – Chuck Brewton, Brock Power Group: 423.718.4675





#### Chevron light-fuels storage facility, San Diego, CA.

The protective design project consisted of a retrofit of an existing separation wall at a Chevron storage facility abutting the BP-Arco unit at San Diego Terminal.

The retrofit included hardening of both sides of the wall (Chevron on one side, and BP-Arco on the other) and encompassed blast, seismic, and corrosion threats. The wall was composed of concrete and, due to exposure to high winds, salt, air, and water intrusion, had suffered extensive structural degradation, nearly to the point of collapse. Additionally, due to the facility's use as a light-fuels storage facility, there was high risk of flash fires, pool fires, and spontaneous blast, as well as the risk of a seismic event triggering blast, fire, or both.

PTG's solution provided resistance to all three threats and utilized a combination of carbon-fiber-reinforced polymer for the blast and fire threats per API requirements, as well as seismic per ASCE 7-05 and California Building Code (CBC), and a spray-applied (via two-stage application) anti-corrosive material and filler (for those wall areas eaten away by wind and water).



Point-of-Contact - Curt Brown, Brinderson Construction: 714.466.7100



#### Monroe Energy Refinery, Trainer, PA.

Protective Technologies conducted a site survey of the Monroe Energy Trainer Refinery on December 18, 2013, which included an investigation of six different buildings for resistance to blast and other hazards. The structural layout of each building and proximity to blast sources were examined thoroughly to develop an understanding of the need for potential upgrade solutions. Protective Technologies followed the site review with a report which included recommendations for retrofit solutions, a blast-resistant modular unit, and other safety considerations for site staff in the existing buildings. Based on the provided information, Monroe Energy selected Protective Technologies and HWH Protective Structures to design and construct a blast-resistant building which would provide additional office space in a safe location for the refinery staff.

Point-of-Contact - Clyde Harcrow: 610.635.6756



#### R.E. Lamb, Valley Forge, PA.

Protective Technologies and HWH Protective Structures are working in conjunction with R.E. Lamb (Valley Forge, PA) to develop and construct a blast-resistant building at the Monroe Energy Trainer Refinery. The PT/HWHPS team is handling the blast engineering and construction of the major structural components, while R.E. Lamb is implementing non-structural items such as HVAC, MEP, and interior office spaces.

Point-of-Contact - Steve Cameron (Project Architect): 610.666.9206



#### The Pyramid Center (TransAmerica Building), San Francisco, CA.

The iconic structure in downtown San Francisco is classified as the second-most visible High-Value/High-Risk target on the west coast of the US per Department of Homeland Security and the FBI.

Completed in 1972, The Pyramid Center is in the center of San Francisco's Financial District and is vulnerable to a wide variety of terroristic threats, including man-borne, vehicle-borne and other. PTG was contacted by the building's owner, following Homeland and the FBI contacting the owner after receiving intelligence that the building had been surveilled as a potential target.

While the scope of both threats and solutions has been withheld at the owner's request and the request of federal law enforcement, we can divulge that the threats package was well above what is characterized as common, e.g. package/satchel bombs and car/truck bombs, and thus the solution set required extensive design and engineering, including high-order, physics-based computational modeling and blast analysis, along with validation of completely new materials systems for blast and ballistic threats.

Point-of-contact is available upon request.





#### World Trade Center Vehicle Security Center (VSC), New York, NY.



The World Trade Center VSC is a below-grade vehicle control and security center; wherein security personnel and law enforcement can inspect, track and route all vehicles, personnel and underground foot traffic (from adjacent NYC subway stations) into and out of the World Trade Center campus.

PTG was contacted by Tishman Construction, the prime contractor for the new World Trade Center campus, and AECOM NYC, Tishman's owner and the Engineer-of-

Record on the World Trade Center construction, to provide a solution for a vehicle-borne IED deployed in the VSC.

Utilizing extensive computational modeling and capitalizing on previous R&D and explosive testing, PTG provided a solution utilizing advanced materials to defeat this threat, which would have created not only tremendous blast pressures in a confined space, but would have produced widespread fragmentation and spall as well, resulting in catastrophic loss of life.

Point-of-contact: Mike Sincavage, Tishman Construction, 646.418.9903





#### Harrison, Walker & Harper Project Examples

#### Lackland AFB Dormitory Renovation | San Antonio, Texas 60,000 SF design build renovation project involving two three-story buildings | Included new mechanical, electrical

60,000 SF design build renovation project involving two three-story buildings | Included new mechanical, electrical and fire protection systems and interior finishes, as well as removal and replacement of exterior brick and roof | Completed on time and in budget



### HARRISON WALKER & HARPER 1887 BUILDERS - ENGINEERS

## Old Method vs. New Method

## **Old Method**



Step 1: Remove Major Portions of Existing Framework and Veneer



Step 3: Secure New Tube Steel to Framing to Existing Wall and Window Components

## **New Method**



Step 2: Design and Place New Tube Steel Framing for Window



Step 4: Reapply Exterior Veneer



Step 1: Prefabricate Retrofit Wall System





Step 2: Tilt and Place

## HARRISON WALKER HARPER 1887

## Part of HWH's integrated, concept-to-completion portfolio







HWH's Industrial Services focus is grounded in 125 years of construction and craft labor experience. We install and implement an extensive degree of the equipment and systems in new facilities, and logically extend these talents to keeping operations running efficiently into the future.

We keep equipment and infrastructure performing at peak efficiency for clients such as Kimberly-Clark, Hydro Aluminum, Florida Power & Light, Western Farmers Electric Cooperative/Touchstone Energy, and a growing number of municipal water authorities and districts.

In addition to ongoing training and a safety record second to none, HWH maintains extensive professional certifications, with steadily expanding geographic coverage.

HWH technicians not only excel in their own specialties—they also understand how each function works in concert with others in the built environment. Examples of HWH industrial services include:

#### **Plant Services:**

Precision millwrights | Certified welders | Certified riggers and crane operators | Licensed plumbers | Equipment installation/relocation | Bearing replacement | Pump and shaft alignment | Structural steel and pipe welding | Outage, shutdown and emergency services

#### Electrical:

Power supply and controls | Thermal imaging

#### Civil/Utilities:

Water and sewer lines and systems | Grading and paving | Site surveys

#### Mechanical/HVAC:

HVAC | Boilers and steam systems | Compressed air systems | Gas supply systems | Process piping (A53, PVC, stainless steel) | Conveyor systems

#### Steel Fabrication:

Structural | Platforms, catwalks and handrails | Fall protection | Hoppers and chutes | Pipe flanges

#### **Energy Solutions:**

Lighting | Solar | Geothermal | Energy audits

HWH professionals appreciate the importance of precision, and its impact on plant safety, schedules, production and budgets. For this reason and more, clients invite HWH teams back and count on their reliability.

#### Industrial Licenses, Certifications and Memberships

- TDLR ACR Contractor: TACLA60200C
- TDLR Electrical Contractor: 20633
- TSBP Plumbing Contractor: M-38611
- State of Oklahoma Mechanical: 140272
- American Society of Mechanical Engineers U Stamp Pressure Vessel Certification: 43253
- National Board of Boiler and Pressure Vessel Inspectors R Stamp Certificate of Authorization: R-7696
- National Roofing Contractors
- Roof Consultants Institute



#### Safety

HWH is committed to the safety, security, and occupational health of employees, subcontractors, clients and the community. We are pleased to partner with our customers in providing the safest working environment.





#### OSHCON

HWH has participated in the voluntary Occupational Safety and Health Consultation (OSHCON) program sponsored through the Texas Department of Insurance, Division of Workers' Compensation, to help identify and eliminate occupational hazards.

#### Safety Program

We have developed a comprehensive and effective safety and environmental health program that endeavors to eliminate unsafe conditions and minimize hazardous situations. Our Safety Team performs in house training and dedicates staff to making regular project and site inspections based on OSHA inspection criteria. HWH has never had a chargeable violation due to an OSHA inspection and strictly complies with all project safety requirements. Each employee's company identification badge that lists critical training, medical, and contact information.

Personnel are trained to be safety leaders in hazard identification and analysis; benefiting everyone involved by reducing illness and injury to personnel, preventing property damage and preserving the environment.

#### 2013 Experience Modification Rating 0.71

- We Develop and Certify Employee Training for
- OSHA 10 & 30 hour for construction
- · Crane operations/rigging
- Powered industrial truck & Aerial Work Platform operation
- $\cdot\,$  CPR and First-aid
- $\cdot$  Fall Protection
- · HAZCOM
- Confined Space Entry & Rescue
- Drug & Alcohol Screening

#### Safety Recognition

- 2010 3rd Quarter Awarded Most Safe Subcontractor by USACE SW District
- 2010-2011 Recognized by Amerisure for Zero Workers Compensation Claims for 313,822 man hours worked
- 2012 2nd Quarter Locally Awarded Most Safe Subcontractor













HWH Protective Structures

## Contact Information

#### **Brian Williams**

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