



Carbon Fiber Reinforced Polymer (CFRP) Systems Prove Effective for Drinking Water Pipe Repairs

Presented By

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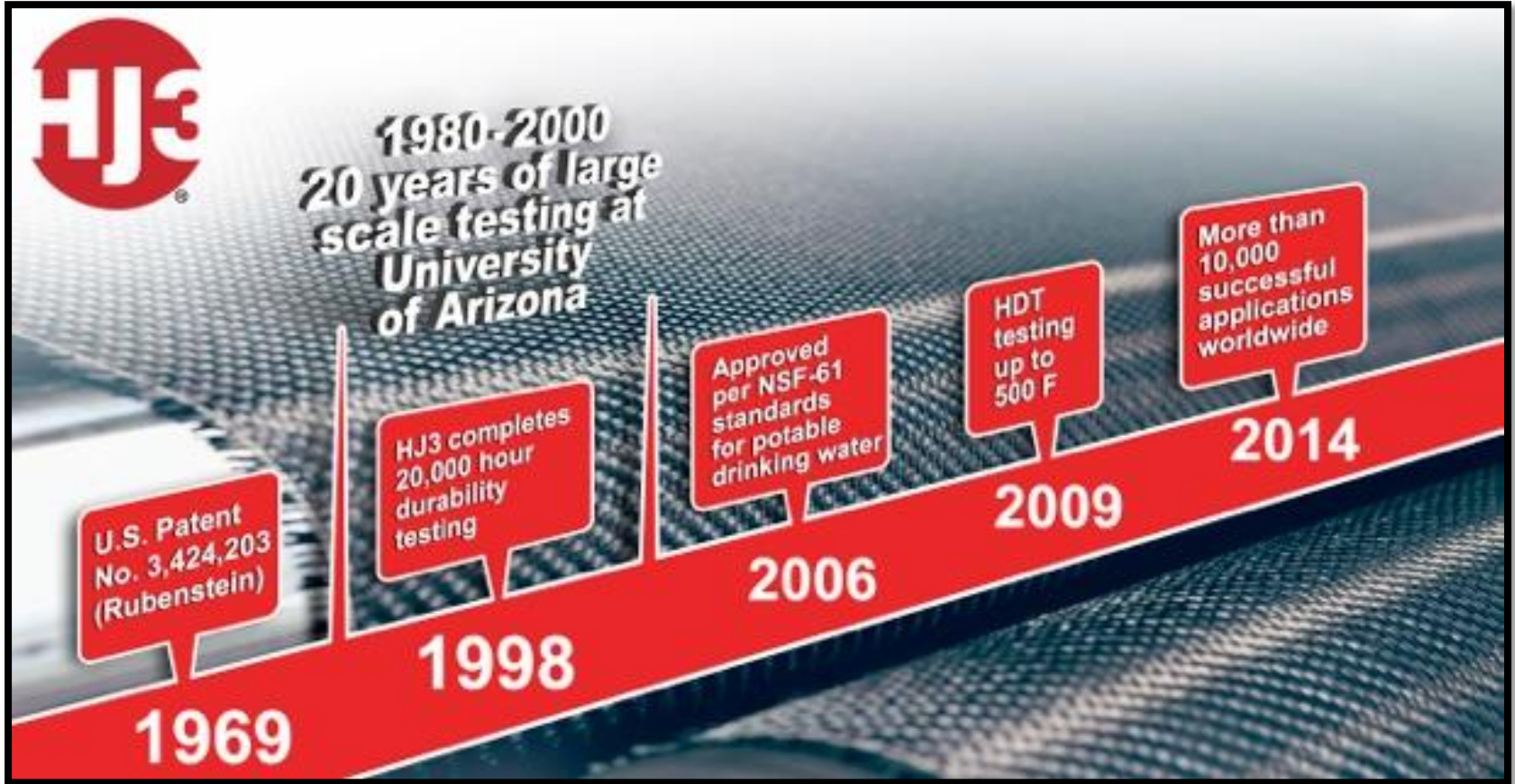
INTRODUCTION

- Around 9,000 miles of 1970's and 1980's PCCP considered “end of life” infrastructure
- 657 water main breaks/day throughout U.S.
- AWWA estimates \$1 trillion price tag over 25 ys.
- Florida alone requires \$12.8 billion for drinking water infrastructure repair

INTRODUCTION CONT'D

- \$19.6 billion required for Florida wastewater infrastructure
- There is an affordable, ANSI/NSF-61 solution that will renew the life of the structure
- Repairs are less costly when implemented prior to catastrophic line failure
- First use of FRP dates back to 1969 Patent #3,424,203 filed by Rubenstein “In Place Repairs for Concrete Irrigation Pipe”

CFRP PROGRESSION OVER TIME



MDWSAD PRE-QUALIFICATION REQUIREMENTS

- Verification installer is a registered Miami-Dade vendor
- Documentation on 5+ independent 48 inch, 150psi pipeline applications within past 3 years
- Documentation on 3+ pipeline rehabilitations with CFRP termination details
- In House Engineer providing sealed drawings

MDWSAD PRE-QUALIFICATION REQUIREMENTS CONTINUED

- Client references
- Written verification that installer's personnel are trained and certified
- Proof of large-scale material testing and long-term durability
- NSF-61 certification, Data Sheets and MSDS

PROJECT #1 REPAIR OVERVIEW: 54 INCH PIPE

- Three 20 foot sections
 - Lock-joint
 - 2 Access manholes
2,200 LNFT apart



PROJECT #2 REPAIR OVERVIEW: 48 INCH PIPE

- Four 20 foot sections
 - Same line of pipe
 - 2 discontinuous segments, 2 adjacent
 - 2 access manholes 1,600 LNFT apart
- Mobilization 3 days after contract award
- All design, engineering calcs, CFRP drawings and ventilation plan docs generated in 3 days

PREPARATION

- Dewatering:
 - Valve shut off by MDWSAD
 - Change in elevation prevented full drainage
 - Repair area between manholes required in-situ dams and hydraulic sump pumps to ensure no water would migrate during repair

PREPARATION

- Condition Assessment:
 - Acoustic test
 - ACI-546 “Concrete Repair Guide” standards referenced for crack repairs
 - Visual inspection found joints had lost 50-75% of circumferential grout covers



- Surface:
 - High pressure sandblasting
 - Minimum ICRI 03732 CSP#3 Concrete Surface Profile
 - Moisture and dust test
 - Steel cylinder prepared to SSPC SP-10/NACE #2 Near White Metal with hand tools

PREPARATION



DESIGNING A PERMANENT REPAIR

Design Scope	Metrics
Design life	50 years
Design operating pressure	150 psi
Surge rated pressure	200 psi
Live load	AASHTO HS20 with 2 trucks passing
Safety factor	Min. 2.0

QC & TRAINING

- Provided to MDWASD inspector staff
- 25 personnel
- Exam issued with a 70% minimum to pass

The inspector staff understands the materials, how they are manufactured and the Quality Control measures required throughout the CFRP installation

INSTALLATION



INSTALLATION



CONCLUSION

- Passed a rigorous pre-qualification process
- Design, calcs and bid approval within 3 days
- Emergency repair executed with highest quality
- CFRP extremely effective for emergency and long-term PCCP rehabilitation