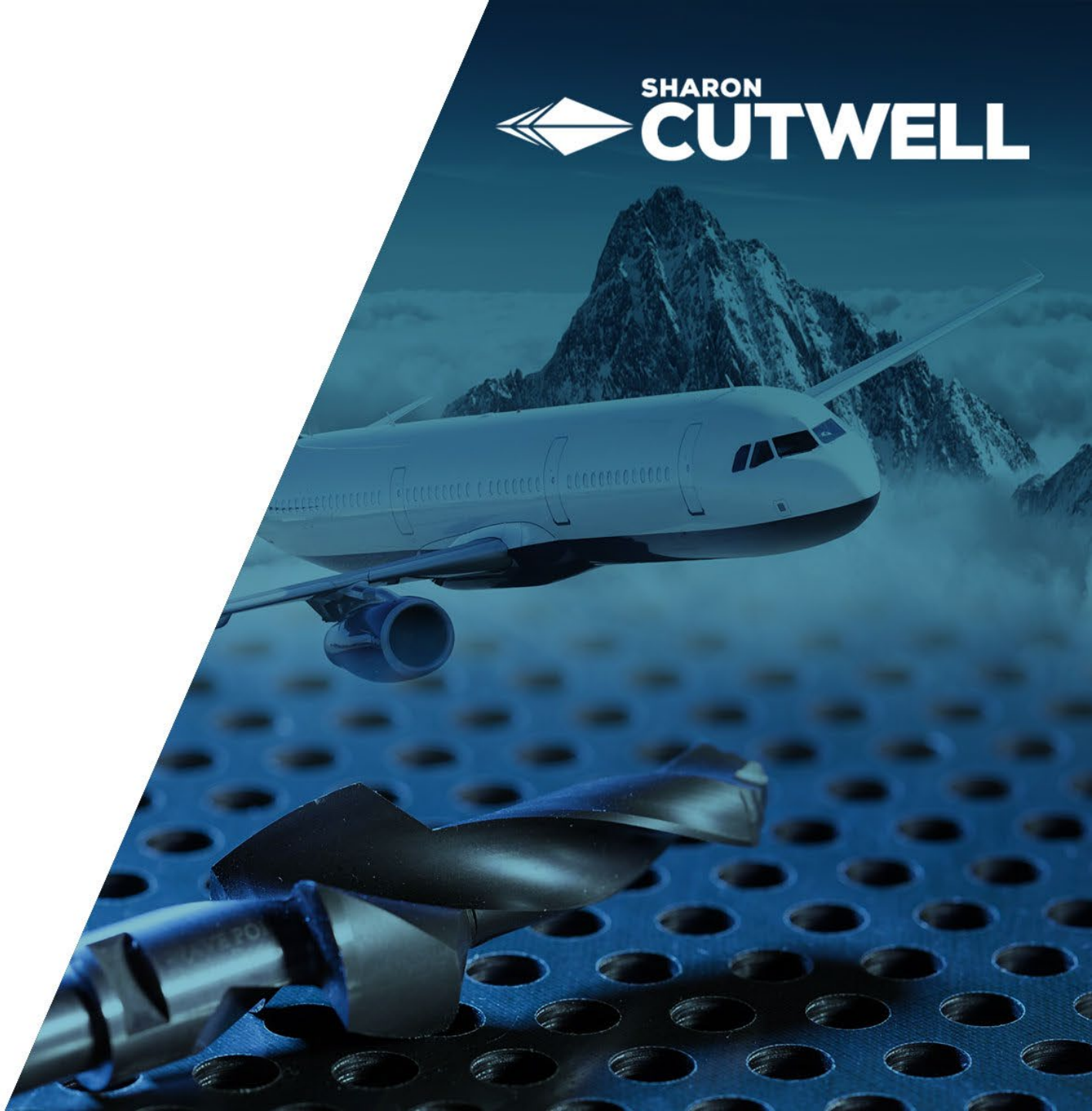
ADVANCED COMPOSITE DRILLING

How to increase drilling speeds and tool life to increase throughput **by more than 7X**

11/2/2022



Introductions

Jeff Prom
President

Scott Prom
Director of Technology & Innovation

Jim Murphy
Applications & Process Development Engineer

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Today's Agenda

- Total Cutwell Solution – How we do it
- Drilling Composites
- Drilling Composite/Metallic Stacks
- Next-Gen Solutions
- Q & A

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Total Cutwell Solution

Advanced Drilling Performance **+**

Expertise & Process Knowledge **+**

Process Support & Improvements **=**

Radically Increased Throughput

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Expertise & Process Knowledge

Experienced Team

- **Scott Prom** – Director of Technology and Innovation
  - Manages Cutwell R & D Center (Process Development Center)
- **Jim Murphy** - Applications & Process Development Engineer
  - 33 yrs Boeing Research & Technology – Assembly Technologies
- **Jeff Prom** – President
  - 30 yrs Leading Sharon-Cutwell Engineering
- **Carl Vogt** – Engineering Manager
  - 15 yrs of Cutting Tool Design & Engineering

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Expertise & Process Knowledge

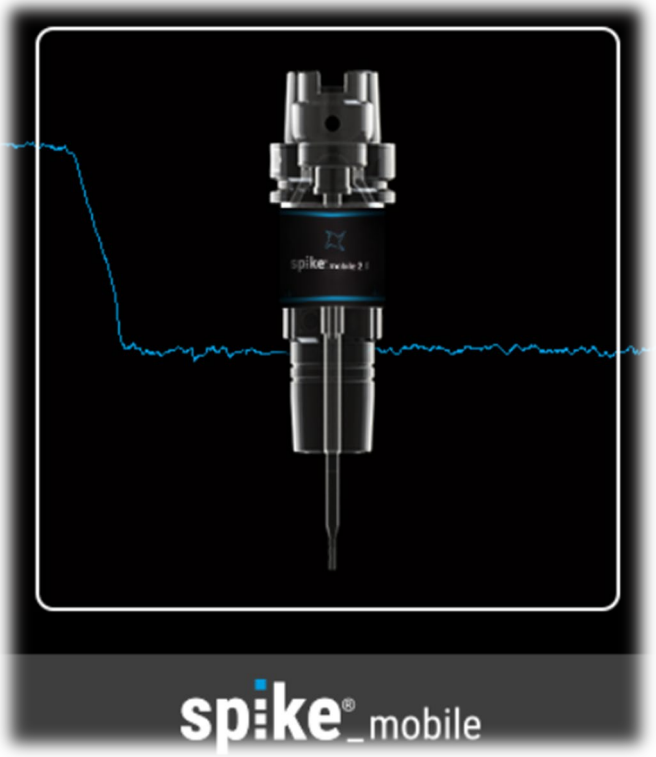
- **Industry Partners** - Integrating & Synthesizing best-in-class Technologies
  - Sensing Technologies and Process Monitoring
    - Force Sensing
  - VAD drilling technologies
    - Vibration Assisted drilling
  - Advanced holding & clamping

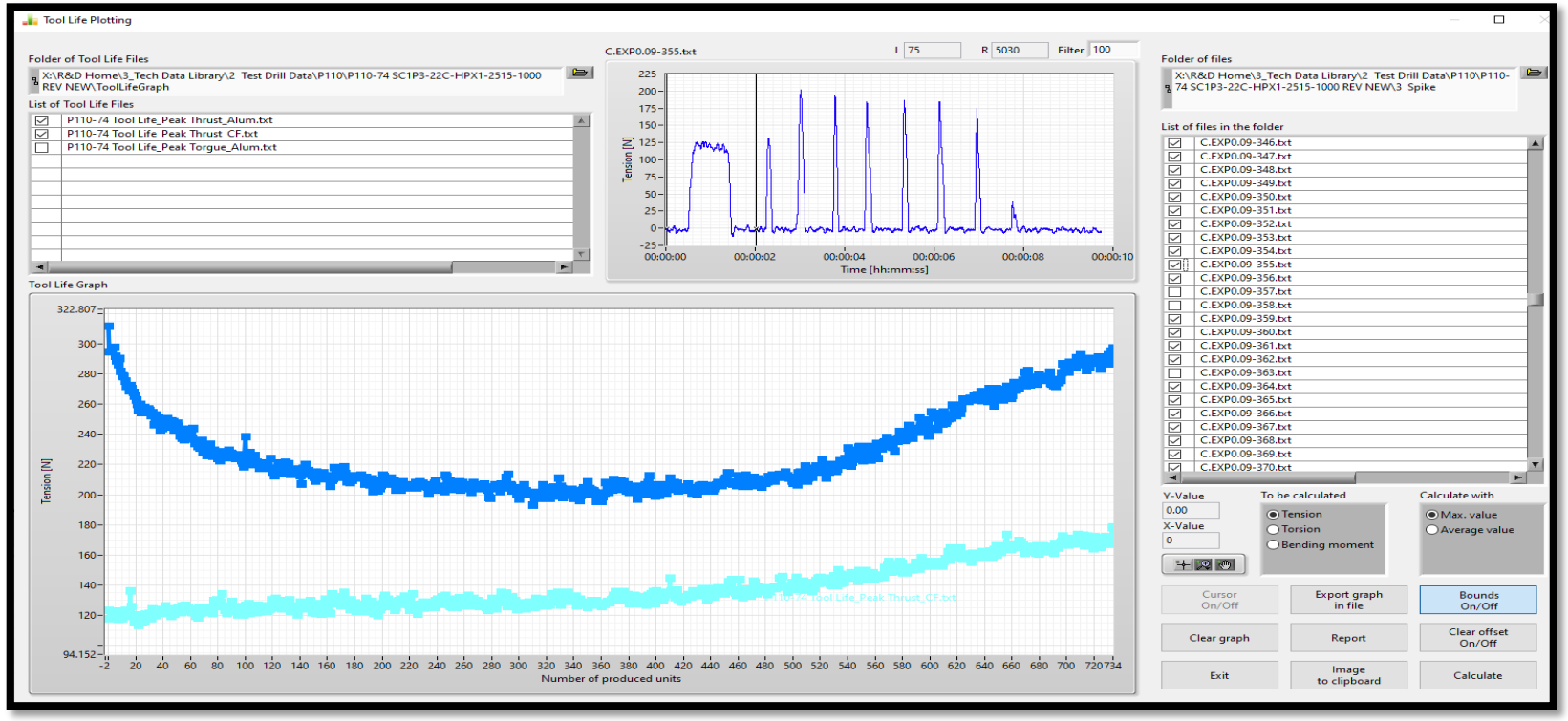
Process Support & Improvements

- Engineering & Process Support
  - New Product Launch
  - Process Improvements
- Process Development Center (PDC)
  - Dedicated In-house R&D Center
  - Process Improvements
  - Problem Solving
  - New Product Development

• PDC: Force Analysis

- Real time data with Pro-Micron spike®
- Tool life studies use spike to monitor health





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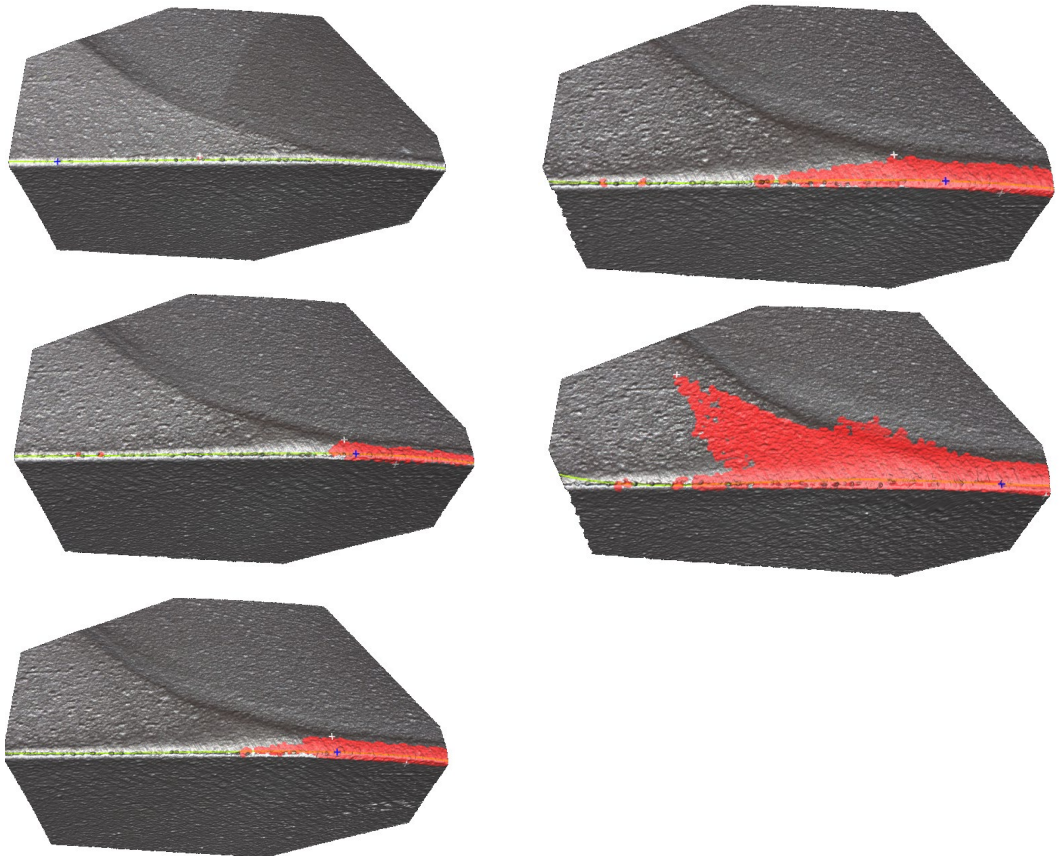
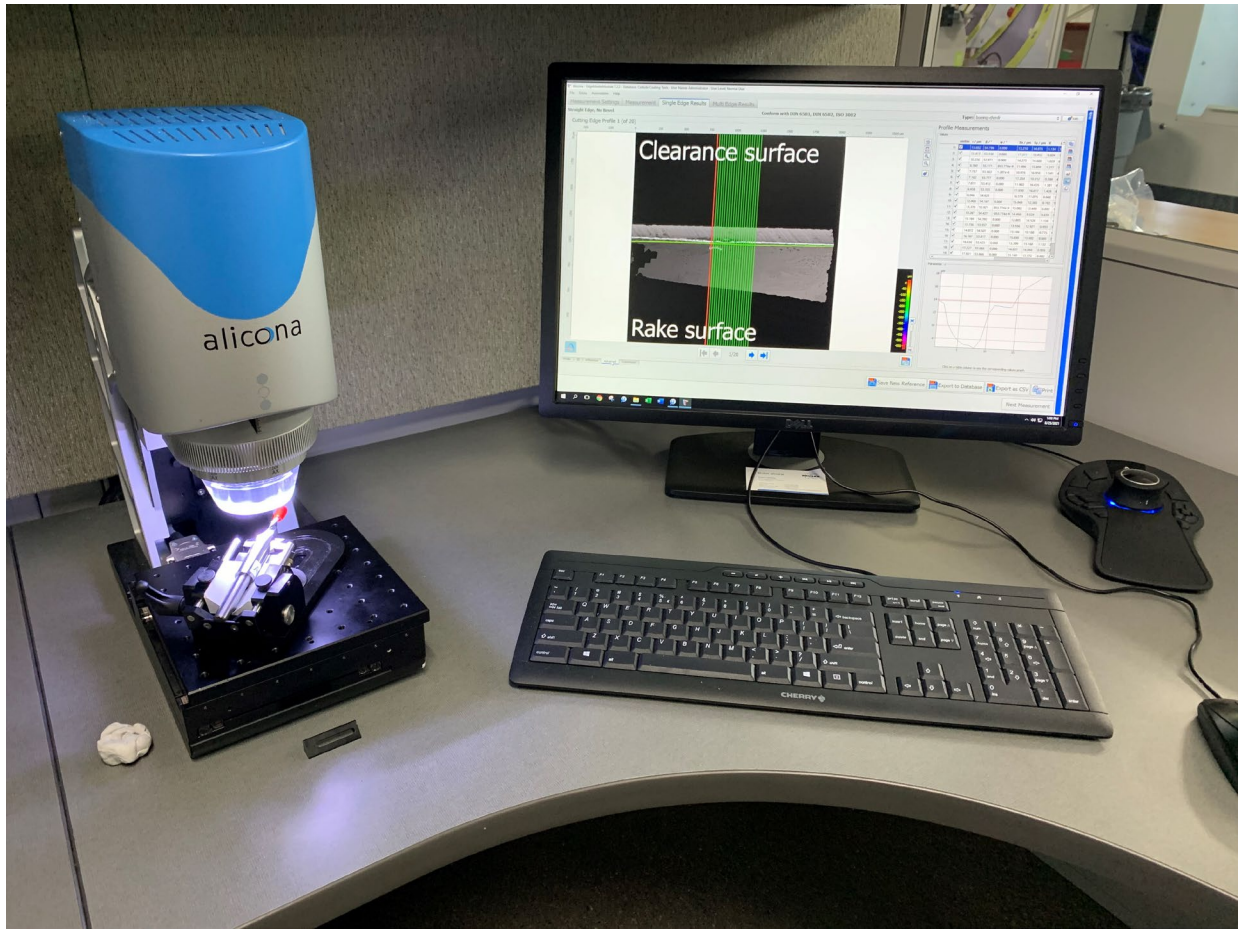
Alicona - Wear Progression & Failure Analysis

(Every 100 holes)





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Total Cutwell Solution

Advanced Drilling Performance **+**

Expertise & Process Knowledge **+**

Process Support & Improvements **=**

Radically Increased Throughput

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Advanced Carbon Fiber Drilling

- **Challenges to Drilling Composites**
  - Highly abrasive
  - Layers of composite fibers
    - Delamination
    - Difficult to get clean holes

- **Solutions**
  - Carbide = cheap, very low life
  - PCD = fragile, expensive, limits on geometry
  - CVD Diamond Coated Carbide Drills

Cutwell's Choice

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Advanced Carbon Fiber Drilling

- **CVD Diamond Coated Drill advantages**
  - Optimized Geometry
  - Highest Speeds, Feeds & Tool Life

Sharon-Cutwell Patented **Wave-Point™** Drills

- 3 solutions optimized for 3 main aerospace applications

Drill Style	Primary	Secondary
SC1P2	CF only	CF / Alum
SC1P3	CF / Alum	CF only
SC1P4	CF / Titanium	CF only or CF / Alum

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Advanced Carbon Fiber Drilling

Cutwell Wave-Point Drills Excel

✓Speed

✓Quality

✓Tool Life

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Advanced Carbon Fiber Drilling

Cutwell Wave-Point Drills Excel

✓Speed

- Speed: 600 sfm; (183 smm)
- Feed: .008” (.20mm) per revolution
- ¼” drill: 8,500 rpm x .008 ipr = 70 ipm (1800 mm/min)

✓Quality

- Precision Hole: .0005” Tolerance (.013mm)
- Minimal Delamination: Clean Entry & Exit

✓Tool Life

- Over 1200” of Carbon Fiber per drill (30m) [1/4” test 500 sfm @ .008 ipr]

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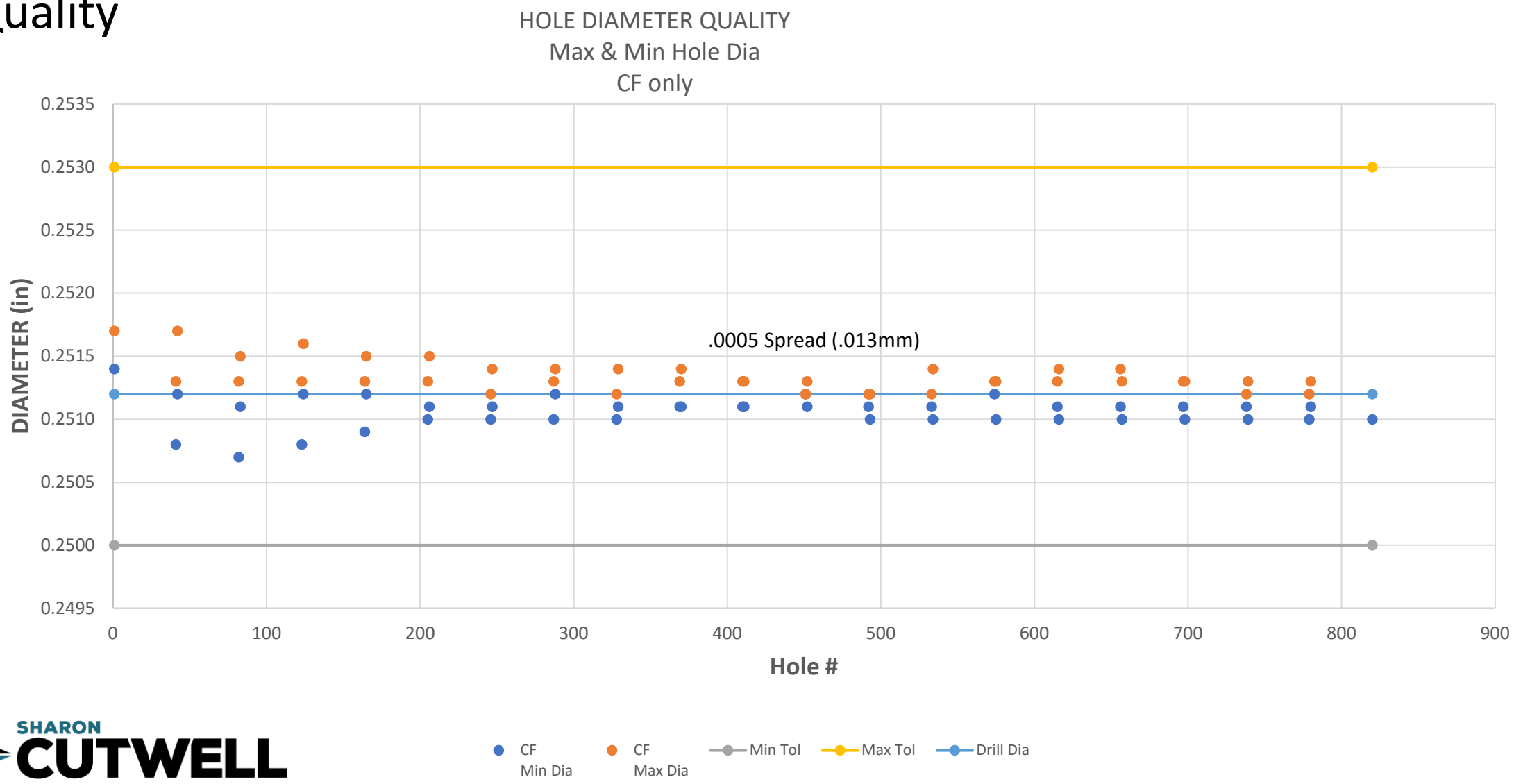
Advanced Carbon Fiber Drilling

✓Speed

https://youtu.be/jF6Y0_aRVow

Advanced Carbon Fiber Drilling

✓Quality



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Advanced Carbon Fiber Drilling

✓Quality

✓Tool Life

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Advanced Carbon Fiber Drilling

Cutwell Wave-Point Drills Excel

✓Speed

✓Quality

✓Tool Life

Productivity = $$

Reduced Costs $$

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Case Study – Boeing 787 CFRP Drilling

- Prior to Cutwell
  - CVD drills at 9 ipm (229 mm/min) x 200 holes
- Cutwell SC1P2 CVD drills
  - 64 ipm (1600 mm/min) x 800 holes
- Greater than **7X increase** in speed
- **Reduced Drilling Time** for major join operation by an **Entire Shift**
- Running in production for 10+ yrs

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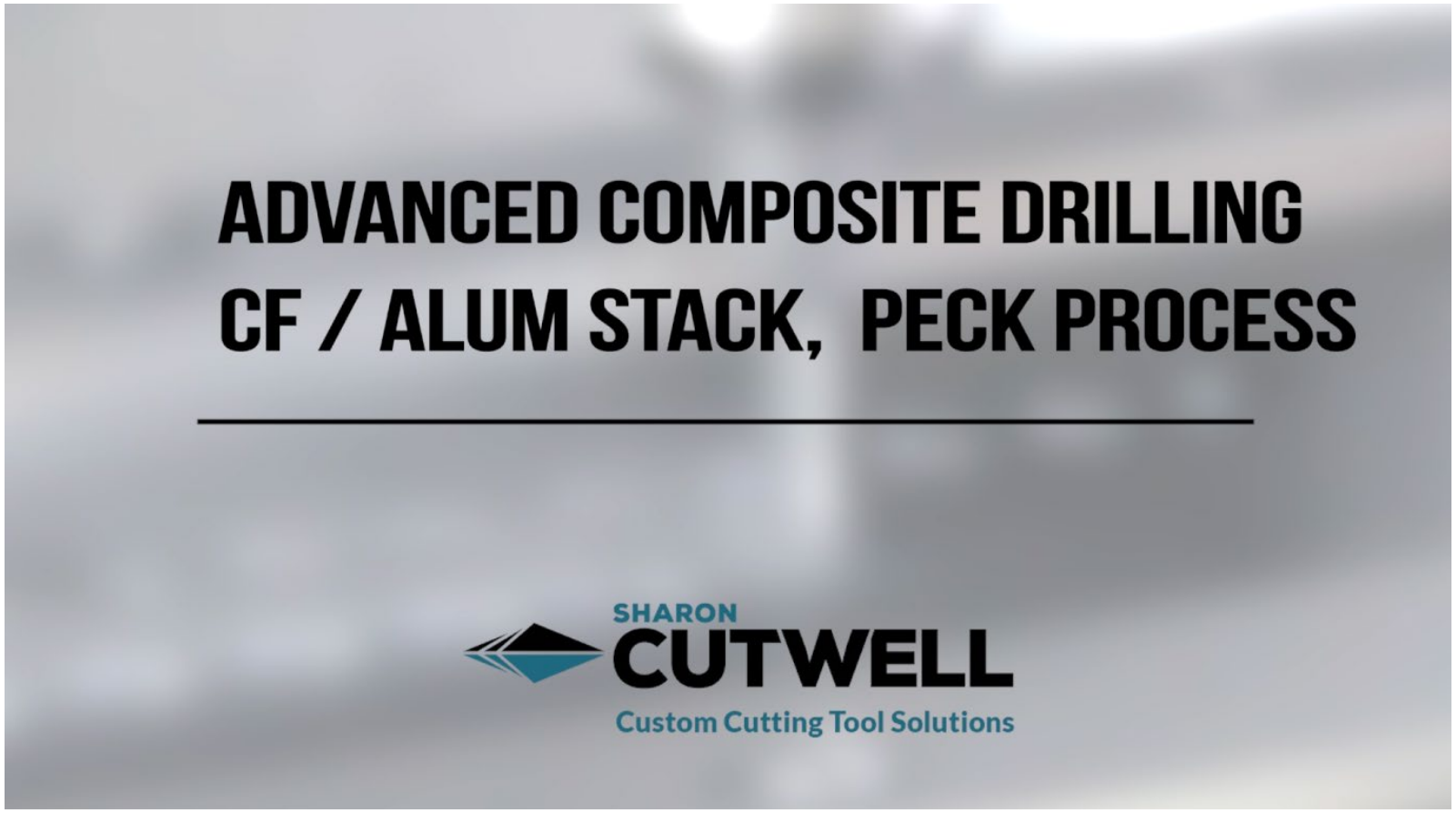
Advanced CF/Metallic Stack Drilling

- CF/Alum & CF/Ti Drilling
- Production Proven – 100's of applications in production
- SC1P3 for CF/Alum
  - 500 sfm x .008 ipr CF; (152 smm x .20 mm/rev)
  - 400 sfm x .008 ipr Alum; Peck drill in Alum (122 smm x .20mm/rev)
  - 800" of tool life ¼" dia drill (20m)
- SC1P4 for CF/Ti
  - 400 sfm x .008 ipr CF (122 smm x .20 mm/rev)
  - 50 sfm x .004 ipr Ti; Peck drill in Ti (15 smm x .10 mm/rev)
  - 150" tool life in .393 Dia CF/Ti/Al/Ti Stack (1.25 thick)

Advanced CF/Metallic Stack Drilling

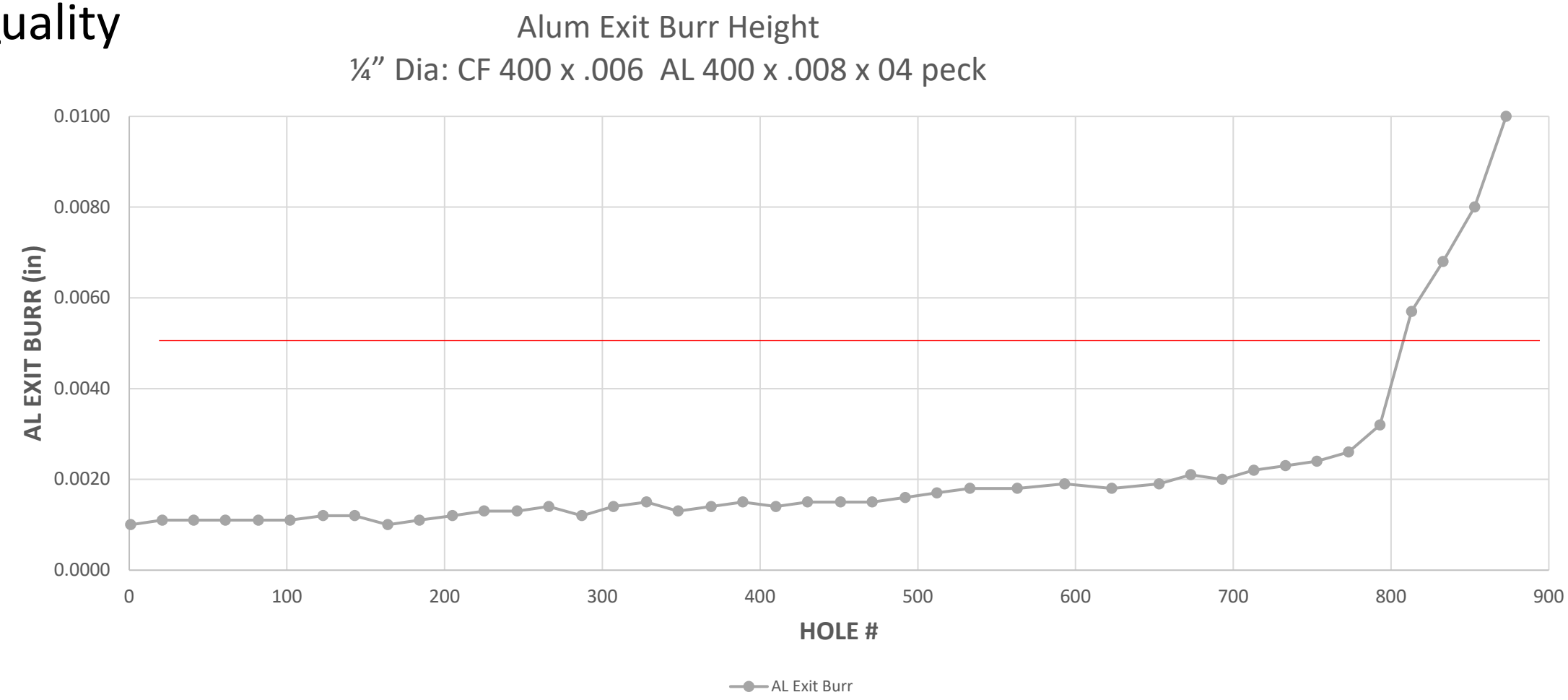
- CF/Alum



https://youtu.be/eXlUlDvCqVs

Aluminum Exit Burr - Typical

✓Quality



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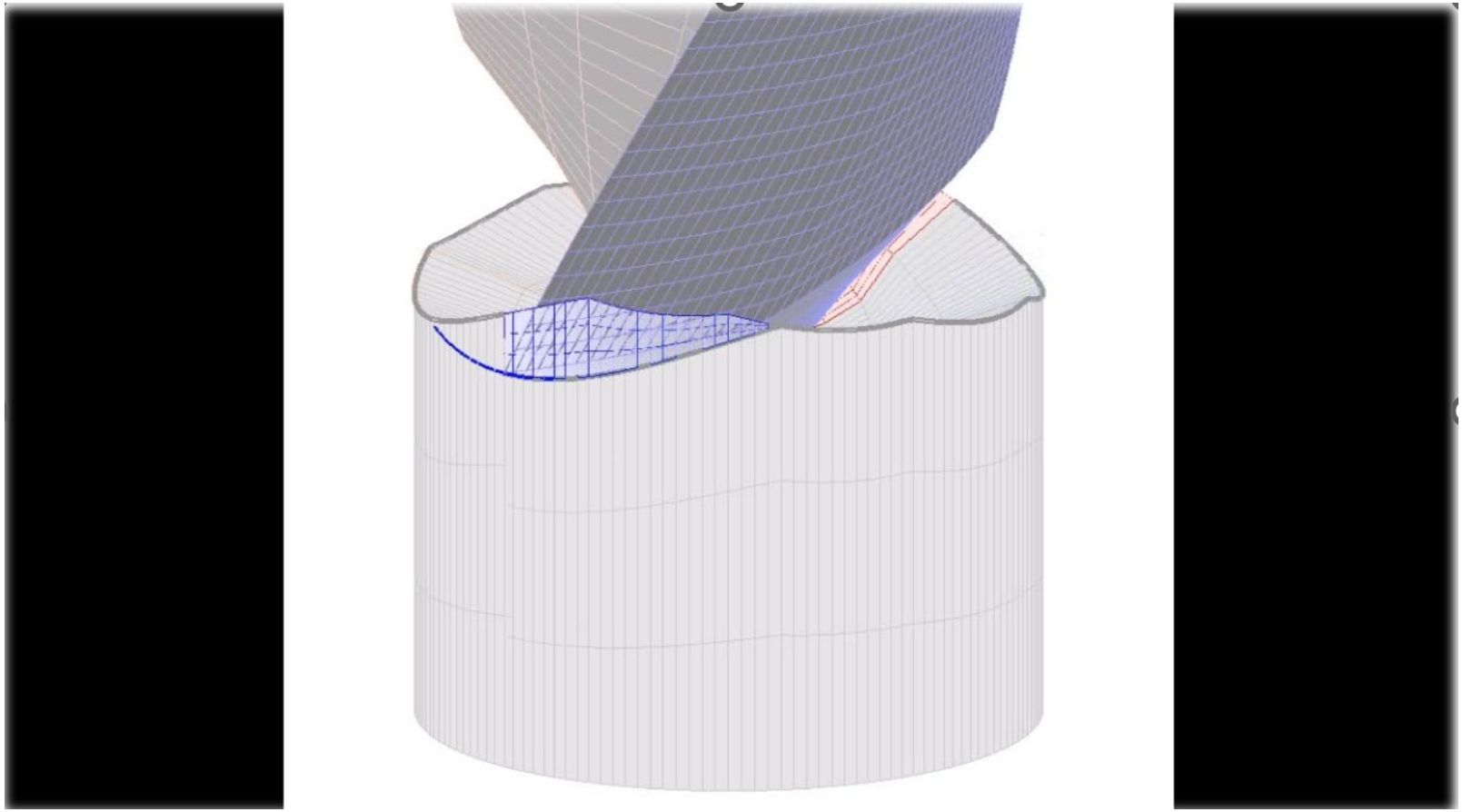
Next Generation Solutions

- **Next-Gen VAD (Vibration Assisted Drilling)**
  - Eliminates Pecking in metallic layers
  - Example: .70” CFRP / .25” Alum Stack; ¼” Drill
    - Current Process
      - CF: 500 sfm x .008 ipr (152 smm x .20 mm/rev)
      - Al: 400 sfm x .006 ipr w/ .04” pecks (122 smm x .15 mm/rev x 1 mm peck)
      - 12 seconds per hole
    - VAD Process: Mitis MS1215 Spindle & Sharon-Cutwell SC1P3 Wave-Point™ Drill
      - CF: 500 sfm x .008 ipr (152 x .20 mm/rev); 7640 rpm x 61 ipm (1550 mm/min)
      - Al: 310 sfm x .0035 ipr (95 smm x .09 mm/rev); 4740 rpm x 17 ipm (432 mm/min)
      - **3 seconds per hole**
  - **4X** improvement in throughput

Next Generation Solutions

- **Next-Gen VAD**



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MITIS

Next Generation Solutions

- **Next-Gen VAD**

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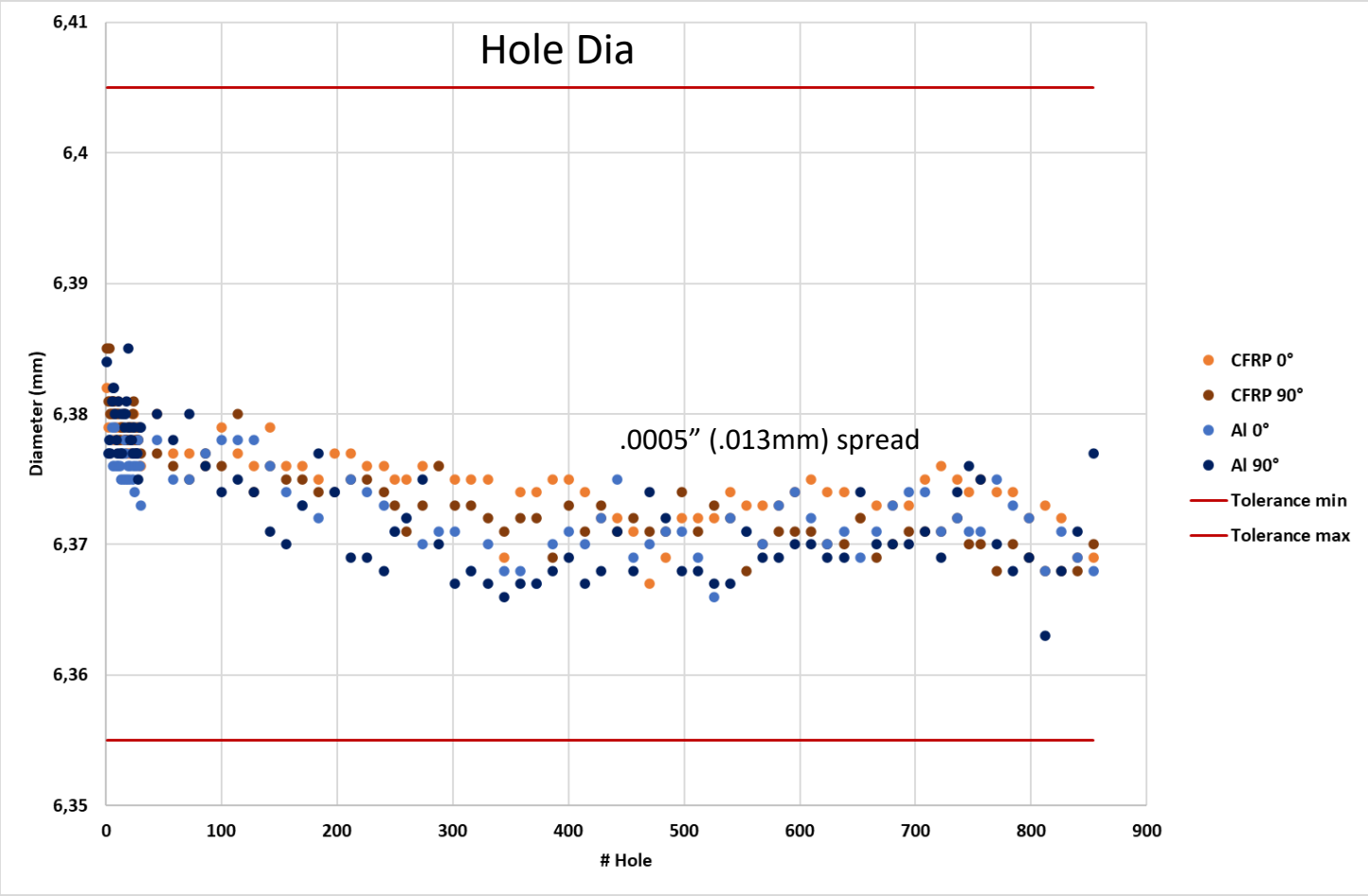
Next Generation Solutions

- **Next-Gen VAD**



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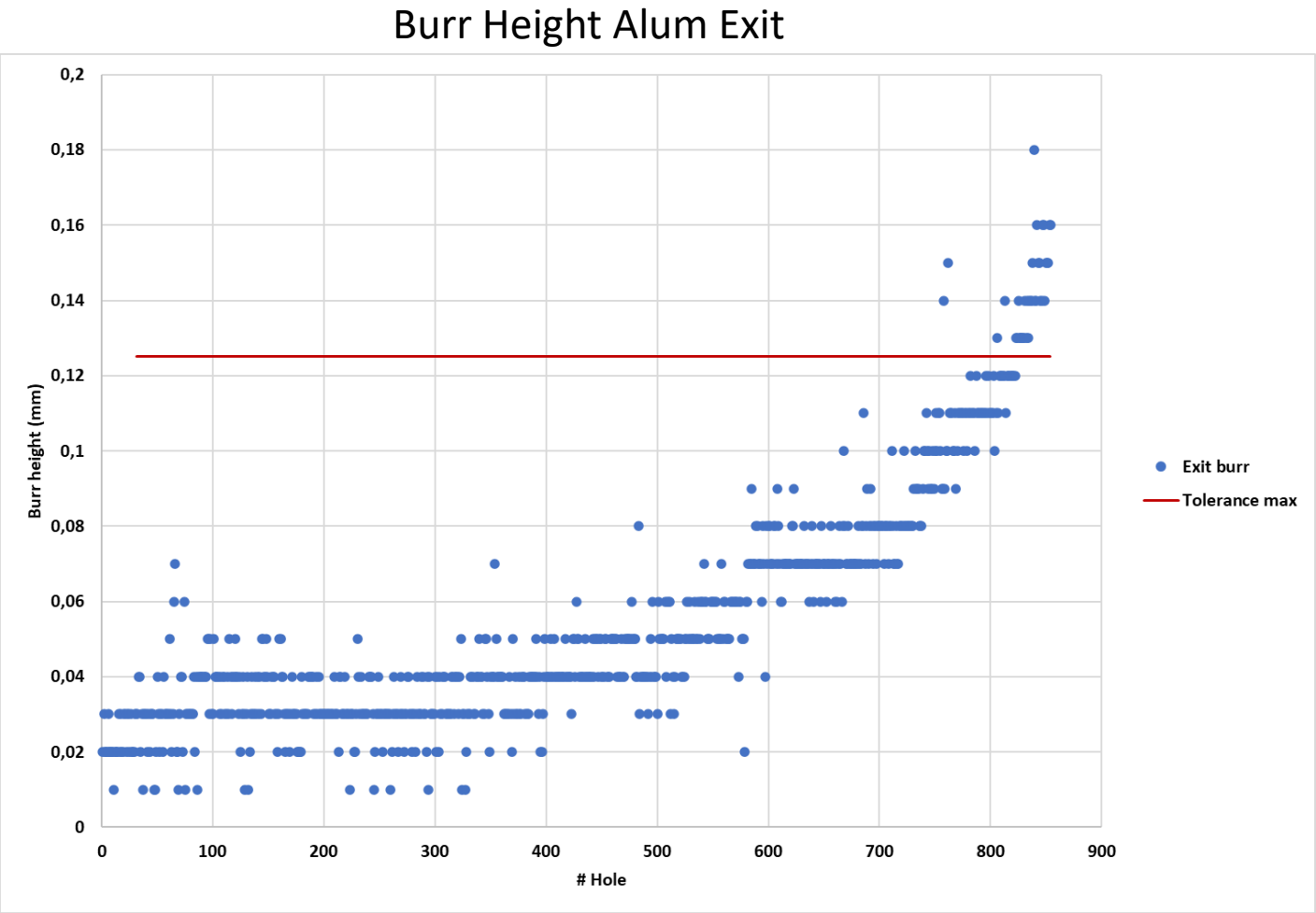
MITIS

Next Generation Solutions

- **Next-Gen VAD**



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MITIS

Next Generation Solutions

- **Cutwell One® Holder**
  - Drill & C’sink applications
  - Reduces cost over 1pc drill/c’sink
  - Ease of assembly/operation
  - Perfectly matches with MQL
  - Ideally matched with REGO-FIX powRgrip
  - Robust Design
  - Excellent runout - .0003” or less
  - High Gripping force
  - Dampens Vibration / Reduced Chatter

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ADVANCED COMPOSITE DRILLING

Thank you for joining us!!

How can we help you?!

www.cutwell.com

Phone: 262-285-7133

Send Inquiries to:

Sales@cutwell.com