

# Flapper Peening

PICKS UP SPEED

Flapper peening (also called roto-peening) looks like such a small, delicate process—more like jewelry making than shot peening. But don't let the equipment size fool you. Flapper peening's benefits are huge and its usage is growing in aerospace maintenance, repair and overhaul (MRO) facilities.

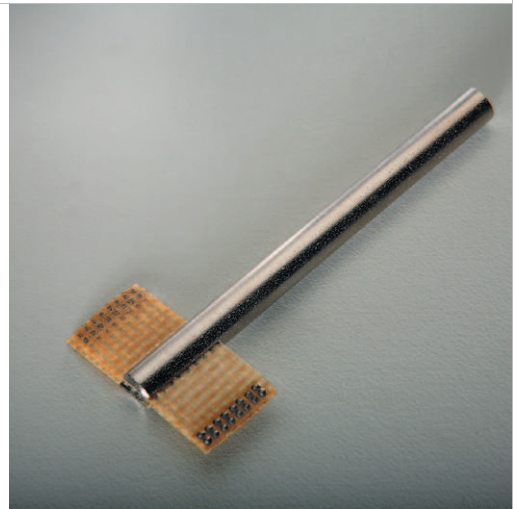
## FLAPPER PEENING WAS THE ANSWER

During the Vietnam war, U.S. Army helicopters were used in greater numbers than ever before in a land war. Repair and maintenance had to be fast and effective, especially on components like rotors. Shot peening was needed but taking the aircraft out of service for any length of time wasn't an option.

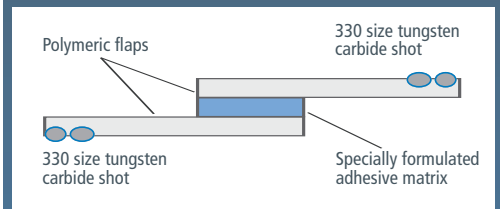
3M™ had the solution. The company worked with tool manufacturers to adapt their TC330 roto peening flap assembly to a flexible shaft tool. The resulting 3M™ Roto Peen Flap Assembly had a small footprint, was portable, and replaced free-flying shot. Because it was capable of repairing gouges, scrapes and corrosion in small and hard-to-reach areas, it was ideal for peening helicopter components like rotor hubs.

In the early 1970s, the TC330 was qualified at Wright-Patterson Air Force Base in Dayton, Ohio and written into the military specifications MIL-R-81840 and MIL-R-81841. Its usage quickly spread to civilian aerospace companies that appreciated its portability and effectiveness.

Flapper peening, however, wasn't limited to the field of aviation. Dr. David Kirk, Visiting Professor in Materials, Faculty of Engineering and Computing at Coventry University, used flapper peening 20 years ago at a billion-dollar steam turbine facility. During commissioning, fatigue cracks started to appear at the roots of the blade/rotor fir-tree assemblies. These areas had not been peened prior to assembly. Disassembly and shipping parts halfway around the world would have cost millions of dollars. "Acting as a consultant, I carried out flapper peening on test blocks followed by the determination of induced residual compressive stress profiles. Results were so encouraging that flapper peening was subsequently carried out in situ on the steam turbine assemblies. To the manufacturer's great relief,



The 3M™ Roto Peen Flap Assembly is a captive shot flap technology that uses high strength resin to bond tungsten carbide shot to a flexible polymeric flap. This provides a cleaner, more precise method than loose shot peening and the uniform 330 shot size contributes to consistent results. The two polymeric flaps are bonded together with a specially formulated adhesive matrix for easy placement in a flap mandrel.



The flap/mandrel assemblies provide convenient portability and are especially effective for precision in-service rework, manufacturing, repair of small areas, and peening holes with diameters down to 1/2" (12.7mm). Flaps can also be cut with scissors to peen confined areas or peen into areas with a radius down to 1/16" (1.6mm).

Applications include:

- Landing gear assemblies
- Wing structures
- Helicopter rotor hubs
- Jet engine support members
- Peening after grinding
- Peening before plating
- Peening of surfaces subject to stress corrosion
- Peen straightening
- Peen forming
- Weld heat affect zone
- Bond testing

RESOURCE: 3M™ Roto Peen Flap Assemblies TC330 Application Notes

no further fatigue failures were encountered in service," said Dr. Kirk.

### FLAPPER PEENING IN TODAY'S MRO FACILITIES

As evidenced by Dr. Kirk, flapper peening can be used in other fields besides aviation but its greatest usage is in MRO. We asked Dave Barkley, a flapper peening trainer with Electronics Inc. Education Division, for his viewpoint on flapper peening's popularity.

**Shot Peener:** Who is using flapper peening today?

**Mr. Barkley:** We're training staff from large aerospace companies, U.S. military bases and small, independent shops.



**Shot Peener:** Flapper peening looks easy, why would you need training?

**Mr. Barkley:** Flapper peening is a manual process and the operator is responsible for more than just pushing a button to initiate a typical automated peening process. Putting residual compressive stress back into the repaired area is as important as the initial shot peening but the flapper peening technician needs to follow different rules from conventional peening and use specific techniques to make it a controlled process.

"Students are excited about what they have learned. They leave the training with a new sense of pride in their craft."  
Dave Barkley  
Flapper Peening Specialist  
Electronics Inc. Education Division

**Shot Peener:** Who attends flapper peening training?

**Mr. Barkley:** In most cases our students are machine operators and artisans that have never worked with shot peening. That's why we make sure our flapper peening training includes a thorough review of all aspects of shot peening.

**Shot Peener:** What components will your students be flapper peening?

**Mr. Barkley:** They're using flapper peening on previously-peened parts that are in for repair or maintenance and require peening on the worked areas. Practically any component that was shot peened can be flapper peened. The big advantage for our customers is when they can repair and peen components like landing gear parts or helicopter rotor hubs without disassembling them. Even sensitive assemblies can be flapper peened because there is no stray media. I don't see it very often, but

flapper peening is also used for part straightening or forming.

**Shot Peener:** What do your students think of flapper peening after training?

**Mr. Barkley:** They are excited about what they have learned. Exposing them to the theory and benefits of shot peening gives them an appreciation for what they are doing. They leave the training with a new sense of pride in their craft.

### Flapper Peening Saves Time and Money for KLM

KLM Royal Dutch Airlines' Engineering and Maintenance Division uses flapper peening for several reasons. One big reason is the size of the parts that need to be peened—they don't fit in a shot peening cabinet. An example is a flaptrack of an airplane. Flaptracks are located in wings and can be up to 8 feet in length. "Often the holes in the flap-track need mechanical rework and then require shot peening," said Marcel van Wonderen, KLM's Master Engineer on Process, Equipment and Materials Development. "In that case, we use flapper peening on the holes."

Sometimes the type of damage calls for flapper peening. "Recently, a landing gear was dented. We had to blend away the dent, which is an initiation point for micro-cracking, and used flapper peening to introduce compressive stress on the blended area," said Mr. van Wonderen.

Additionally, KLM flapper peens parts that have to be peened on site. Oxide removal with blending is typically done locally and KLM's mechanics flapper peen the worked area to compensate for the tension stress induced by the blending and to increase resistance to oxidation.



KLM flapper peens small areas on large components, like the holes in the flaptrack from a wing.

Flapper peening's convenience and portability saves money for KLM. In the case of the dented landing gear mentioned above, it would have cost \$80,000 to remove the landing gear from the plane, take the landing gear apart and send the part to the engine shop. Figured into the cost is also the repair activities and turn-around time of three days (turn-around time is a big issue in the aircraft overhaul business). "The whole flapper peening procedure was completed in only 20 minutes and cost maybe \$150," said Mr. van Wonderen. Some repairs, such as removing oxide spots and peening afterwards, can only be done with flapper peening. Mr. van Wonderen asked, "How do you calculate the cost savings on that?"

### THE FUTURE OF FLAPPER PEENING

Two advancements are enhancing flapper peening's position as a viable, controllable process: a relevant and accurate specification and a RPM controller. The SAE Aerospace Metals Engineering Division's Shot Peening Sub-Committee is developing an AMS version of a flapper peening specification intended to displace the MIL-R-81841 specification. MIL-R-81841 has several erroneous concepts and requirements.

Shockform's FlapSpeed™ controller brings a new level of control and confidence to the flapper peening procedure. "Several of our clients in the aerospace sector have told us that they liked the flexibility, speed and cleanliness of flapper peening but they wished that the process was more controlled," said Sylvain Forgues, co-owner of Shockform. Furthermore, new requirements such as the Nadcap audit criteria AC7117/4 requires that companies use "flapper peening equipment capable of maintaining the required RPM to consistently conform to the required intensity values". Until now, this requirement was difficult to fulfill since no RPM controller was commercially available for flapper peening. The recently-released patented controller is small, robust and easy to use in a production or MRO environment. "It will help users meet their quality requirements for the flapper peening process," said Mr. Forgues. ●

### Resources

**3M™ Roto Peen Flap Assemblies TC330**  
Electronics Inc. 1-800-832-5653 or 1-574-256-5001  
www.electronics-inc.com

### Flapper Peening Training

Dave Barkley, Flapper Peening Training Specialist  
Electronics Inc. Education Division  
dave.barkley@electronics-inc.com

### FlapSpeed™ Controller

Sylvain Forgues, co-owner of Shockform Inc.  
1-450-430-8000  
info@shockform.com or www.shockform.com

# Get up to speed on flapper peening

with flapper peening training from the experts



*Flapper peening is ideal for repairing small and hard-to-reach areas. Flapper peening can be done in the field, making the time-consuming and expensive disassembly and transportation of components unnecessary.*

Flapper peening is one of the fastest-growing shot peening methods—it's effective, economical and fast. Electronics Inc. Education Division offers one-day on-site training programs for companies and military bases that want to expand their flapper peening skills.

Our flapper peening training will:

- Help you achieve a controllable process
- Increase your operators' skill
- Demonstrate how to achieve compliance to specifications and standard practices
- Expand your use of this productive process

Our training program is beneficial to operators, supervisors, inspectors and application engineers.

**Mechanics that are qualified under FAA rules to perform inspections may receive credit for taking this class.**

**Ask us for more information.**

1-800-832-5653 (U.S. and Canada) or 1-574-256-5001  
or visit [www.electronics-inc.com](http://www.electronics-inc.com)



**Electronics Inc.**  
Education Division



*Get flapper peening training from the company that knows how to do it right. Jack Champaigne, President of Electronics Inc., is the Chairman of the Shot Peening Sub-Committee of the Aerospace Metals Engineering Committee of the Aerospace Materials Division of SAE. His committee will be responsible for writing the new flapper peening specification. EI provides flapper peening training to aerospace companies and military bases worldwide.*