SERDP / ESTCP WORKSHOP

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MESSIER-DOWTY / HVOF IMPLEMENTATION

Messier-Dowty
SAFRAN Group

Report Documentation Page

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MESSIER-DOWTY, PRODUCTION FACILITIES

- **Bidos, France**
  - Manufacturing centre for shock strut / shock absorber
  - HVOF requirements on pistons for various programs
  - M-D currently considering to invest into HVOF technology
- **Gloucester, United Kingdom**
  - Manufacturing centre for axles / truck beam (bogie beam)
  - HVOF requirements on axles for various programs
- **Toronto, Canada**
  - Manufacturing centre for business, regional and military programs
  - Assembly line for the B787 program
  - HVOF requirements on a wide range of components
  - One HVOF booth
- **Montreal, Canada**
  - Manufacturing centre for cylinders (main fittings) on Airbus / Boeing commercial program
  - HVOF requirements still in the early phase due to size of the components
- **Suzhou, China**
  - Manufacturing centre for non complex components on various program
  - HVOF investment being considered

MESSIER-DOWTY, HVOF REQUIREMENTS

Existing programs

- Falcon 7X (Dassault) – Business program
- A380 Nose Gear- Commercial program
- A400M Main & Nose Gear – European military program
- B787 – Commercial program
- A350 Main Gear – Commercial program

Every new program at Messier-Dowty will require HVOF coating as replacement to chrome plating whether it is a European or North American programs

Still some exceptions on large components

- Internal small bores (micro gun ???)
- Internal diameter on cylinders (ID gun ???)
- Spigot (rotating equipment ???)
- OEM will require eventually such exceptions to be removed and converted to HVOF

MESSIER-DOWTY, GEOGRAPHY VS MARKET

- **M-D located in 3 distinct geographic areas**
  - North America
  - United Kingdom
  - Western Europe
- **European approach to HVOF technology**
  - HP technology (kerosene system) superior to LP technology (hydrogen system)
  - Market dominated by Praxair JP 5000 / 8000 and / or SM Woka Jet 350 / 400
  - Approval process strenuous for potential suppliers
- **North American approach to HVOF technology**
  - Participation to HCAT
  - LP technology and HP technology are comparable
  - Simplification of the approval process for potential suppliers
- **Approval process has been simplified**

MESSIER-DOWTY, APPLICABLE SPECIFICATIONS

HVOF THERMAL SPRAY – PCS 2560

- Application of tungsten carbide cobalt chromium coatings on metallic parts by High velocity oxygen / fuel (HVOF) process
- Largely inspired by AMS 2448

QUALIFICATION PLAN FOR PCS-2560 SUPPLIERS

- Stipulates M-D approval process and commercial requirements

HVOF POWDER – PCS 2561

- Tungsten Carbide Cobalt Chrome Powder, Agglomerated and Sintered
- 86 WC – 10Co – 4Cr
- Largely inspired by AMS 7882

GRINDING REQUIREMENTS – PCS 4102

- Grinding of HVOF Sprayed Tungsten Carbide Coatings applied to Steel

MESSIER-DOWTY, HVOF REQUIREMENTS

FUTURE REQUIREMENTS

	Number of parts		
Sites	2008	2009	2010
Montreal	158	286	445
Bidos	204	381	596
Gloucester	1 750	3 600	6 200
Toronto	330	330	330
Suzhou		1 800	9 300
Total	**2 442**	**6 397**	**16 871**

Montreal	Main Fittings	A350 / A380 / B787
Bidos	Sliders	A350 / A380 / B787 / F7X / A400M
Gloucester	Pins	A350 / B787
Toronto	Main Fittings + Trailing Arm + Piston F7X	
Suzhou	Pins	B787

Excludes indirect requirements for A400M / A380 / F7X program.
Estimated to an additional 5 800 parts in 2010.

MESSIER-DOWTY, QUALITY SYSTEM REQUIREMENTS

COMPLIANCE TO PRIDE MANUAL

- Process Requirements In Developing Excellence
- Stipulates Messier-Dowty quality requirements for suppliers

AS 9100 APPROVAL REQUIRED TO BECOME M-D SUPPLIER

- EN 9100, AS9100 or JISQ9100
- Prerequisite to become a M-D approved HVOF spray supplier
- Immediate requirement

NADCAP ACCREDITATION

- All special processes shall be certified NADCAP by target dates
- Target data for HVOF: December 31st, 2008
- Mandatory requirement from Boeing for B787 components

MESSIER-DOWTY, COMMERCIAL REQUIREMENTS

SUPPLIER TO BE RESPONSIBLE FOR THE FOLLOWING ACTIVITY

- HVOF Thermal Spray per PCS-2560
- HVOF Grinding, Super Finishing and Inspection per PCS-4102
- Surface Texture Inspection per PCS-2565
- Magnetic Particle Inspection (MPI – if required) per PCS-3100 (or equivalent)
- Grinding and Super Finish could be sub-contracted by HVOF spray shop
  - Grinding source to be approved by Messier-Dowty
  - HVOF spray shop still commercially responsible for quality of products
- MPI could be sub-contracted to a M-D approved source

HVOF – SUPPLIERS REQUIREMENTS

MESSIER-DOWTY 'MAKE' PARTS

- Messier-Dowty 'MAKE' parts are parts machined by M-D facilities. These parts are typically very large and heavy and require handling to manipulate
  - M-D BIDOS (France): Sliders or piston (Straight shape or T shape)
  - M-D Gloucester (UK): Axle (long cylindrical component) and truck / bogie beam
  - M-D Montreal (Can): Cylinders or Main Fittings
- M-D outsourcing requirements is only for HVOF spray since M-D already owns grinding equipment
- Even if M-D invest into HVOF technology, outsourcing will still be required

HVOF – SUPPLIERS REQUIREMENTS

MESSIER-DOWTY 'BUY' PARTS

- Messier-Dowty 'buy' parts are components machined and assembled by M-D various suppliers
- Most of these suppliers do not have processing capability. Special process shall be conducted through approved M-D suppliers
- Several small suppliers with limited resources to manage sub-tiers.
- M-D would prefer to have 'one-stop shop' taking care of all operations:
  - Nital etch, MPI, shot peen, HVOF, grind, inspection,cad plating, paint, etc…
- Bare minimum: HVOF, grind, inspect & NDT

HVOF – SUPPLIERS REQUIREMENTS

QUALIFICATION PROCESS

- Supplier to present a plan with minimum processing services
- Plan to be reviewed by M-D
- M-D lab and QA to audit suppliers to ensure that quality and processing are acceptable
- Design for experiment (DOE) to be completed by suppliers to demonstrate optimization and repetitiveness of spray parameters
- Supplier to procure material and machined to round axial specimens (ASTM-E-466)
- Supplier to spray the test samples
- Supplier to sub-contract samples testing to approved M-D laboratories
- Upon completion of the tests and acceptable results, notification of conditional approval to be sent by M-D
- Corrective actions from previous audits to be closed
- Final approval

HVOF – SUPPLIERS REQUIREMENTS

ADDITIONAL QUALIFICATION PROCESS INFORMATION

- Approval process is material specific
  - Approval process for 300M is valid for low carbon steel and all stainless steel
  - Approval process for titanium
  - Approval process for Custom 465
  - A given supplier could pass its approval for steel substrate but fail for titanium substrate
- First few pieces to be coated and ground by a new supplier will have to be Rollscan
  - Barkhausen Noise Test
  - Activity to be done by supplier at its facility or at M-D facility
- Within 12 months of conditional approval, suppliers will be requested to purchase and install on-line monitoring equipment for thermal spray booths
  - Accura Spray
  - Spray Watch

MESSIER-DOWTY, LESSONS LEARNED

- Capacity available in the marketplace is limited
  - Lots of spray shop in the market
  - Capacity to meet aerospace reqs is more difficult than traditional spray market
  - Developing a good new supplier is a lengthy process
- Never split between spray source and grind source
- Consider spray and grind as two separate markets
  - Capacity problem is probably even more severe for grinding
  - Lots of grinding knowledge in the market for chrome
  - Transition from chrome grinding to HVOF grinding is not easy
- Start your supply chain development very early in the process
  - B787 program highlighted this need due to rapid program in monthly build-up rate
- Dedicate full-time resources to the assignment
- Preference for the one-stop shop concept

MESSIER-DOWTY, CONCLUSION

- Still looking for suppliers willing to embrace the challenge
- M-D business model calls for supply chain to grow
  - US dollar zone
  - Emerging countries (LC) zone
- Areas of development in dollar zone
  - West Coast
  - Mid-West
  - North-East
- Areas of development in LC zone
  - Mexico
  - India
  - China