



Advanced Manufacturing Process Technology Transition and Training Center

FY' 15 Annual Report & Budget Presentation

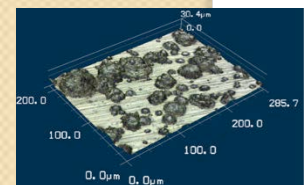
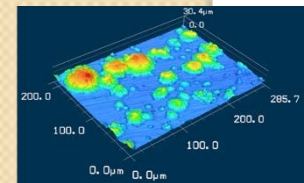
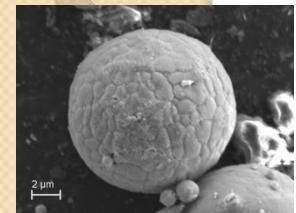
Research & Commercialization Council Meeting

June 11, 2015 - 1:00 – 4:30 p.m. (CST)

Sioux Falls, SD

Christian Widener

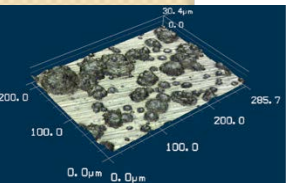
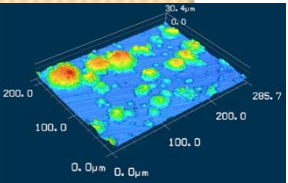
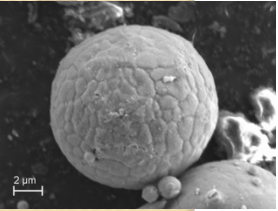
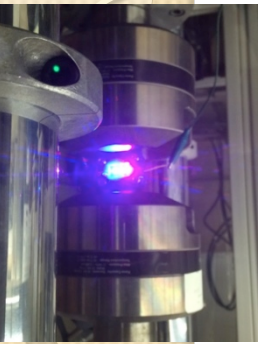
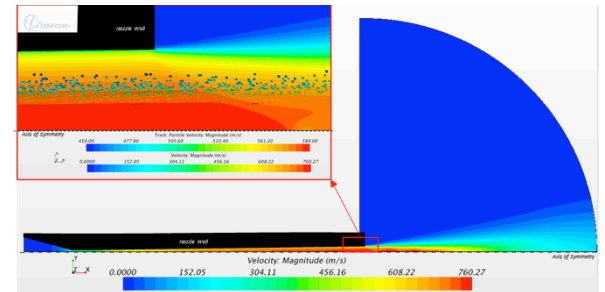
Center Director



Major Research Highlights #1

Cold Spray Development

- SDSM&T is now a Recognized Leader in Cold Spray
- Prepared 11 journal articles for publication this year.
- Invited to speak at both major cold spray venues: CSAT and the North American Cold Spray Conference.
- Cold spray start-up company VRC Metal Systems, LLC is growing rapidly – 2015 Black Hills Start-up of the Year
- Orders for a total of 8 cold spray units have been received.
- Established an Air Force cold spray development team with RIF funding for part qualification.
- Cold Spray funds over 60% of lab activity.



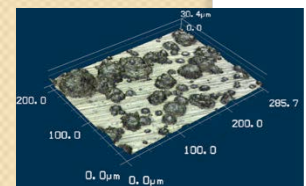
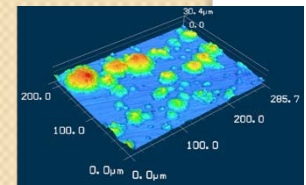
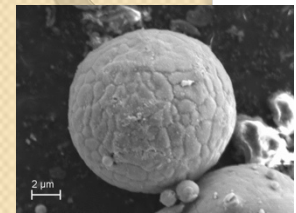
Major Research Highlights #2



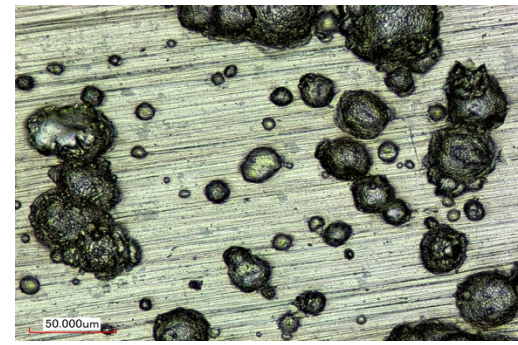
SOUTH DAKOTA
STATE UNIVERSITY

Advanced Motion System for Intelligent Manufacturing

- Installed the 6-axis motion system in the AMPTECH lab that has been in development for 2 years at SDSM&T.
- Work in-progress for motion control, tuning, and integration.
- OPPORTUNITIES: Large research grants (popular emerging field) & sales of similar systems. (\$900K-\$1.6M)



Collaboration



SDSU

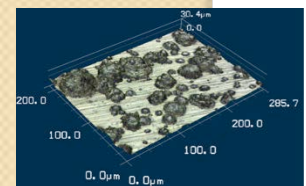
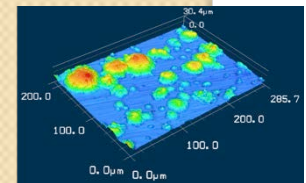
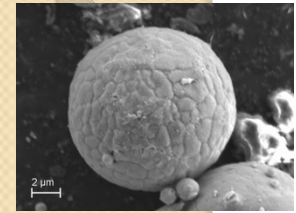
- Cold Spray Material Analysis
 - Cold Spray Impacts for Nozzle Modeling Verification – Ph.D. Project
 - Titanium Cold Spray Surface Analysis for Implant Applications – Ph.D. Project
 - Regular visits between institutions to carry-on collaboration

INDUSTRY

- HF Webster/VRC Metal Systems - \$450K
- Core Member - Cold Spray Action Team – Army Research Lab, MOOG, United Technologies Research Center, Penn State Applied Research Lab - \$400-500K/yr.
- Nordson-Xaloy – Sponsored Research Agreement - \$200K/yr.
- Other Significant Developing Relationships
 - American Axle, GRACO, CAT, New Tech Ceramics, Daktronics, Airbus

ADVISORS

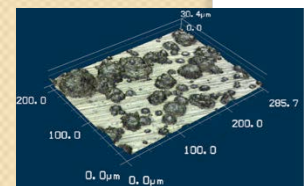
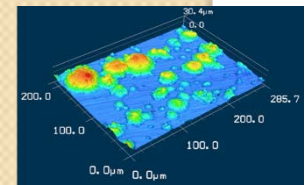
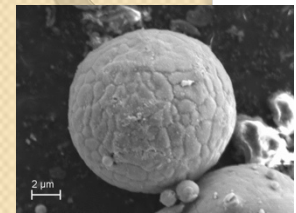
- Darren Haar, Joseph Wright, Jan Puszynski, Rob Hrabe, Craig Bailey, Ron VanHorssen, Michael West, Jamie Hale



Grant Activity

- 46 proposals in 2 years, 22 of them successful.
- Over \$1M this year [\$2.3M in research awards to-date]
- There are another \$3.5M in proposals pending and another \$1.9M in planning for FY'16.

<i>Fiscal Year Activity</i>	<i>Pending</i>	<i>Declined</i>	<i>Awarded</i>
<i>Previous Fiscal Years</i>			
<i>Total Number</i>	6	1	14
<i>Funding Amount</i>	\$1,488,500	\$5,000,000	\$1,322,835
<i>Fiscal Year 2015</i>			
<i>Total Number</i>	15	2	8
<i>Funding Amount</i>	\$1,868,500	\$999,502	\$1,027,056
<i>Comprehensive Total</i>	\$3,357,000	\$5,999,502	\$2,349,891

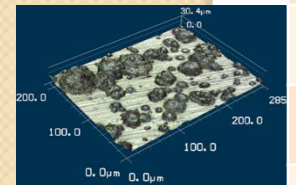
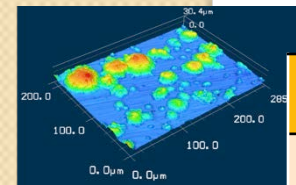
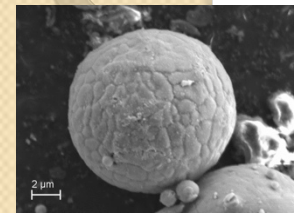


Center Funding

- The center is on track to continue this level or increase it in FY' 16.
- Research projects totaling \$578K with 32 different companies were completed in FY' 15.
- An additional \$2.2M has also been stimulated within the state for research partners.

<i>Fiscal Year</i>	<i>State</i>	<i>Federal</i>	<i>Industry/Other</i>	<i>Total</i>
<i>FY14</i>	\$419,198	\$319,971	\$158,928	\$898,097
<i>FY15</i>	\$432,000	\$399,992	\$578,168	\$1,410,160
<i>FY16*</i>	\$475,000	\$425,000	\$600,000	\$1,500,000
<i>FY17*</i>	\$400,000	\$500,000	\$650,000	\$1,550,000
<i>FY18*</i>	\$400,000	\$600,000	\$700,000	\$1,700,000
<i>FY19*</i>	\$500,000*	\$700,000	\$750,000	\$1,950,000
Total	\$2,626,198	\$2,944,963	\$3,437,096	\$9,008,257

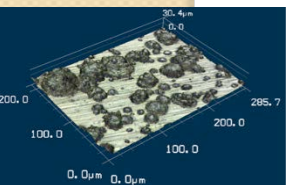
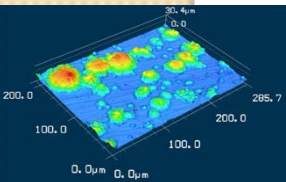
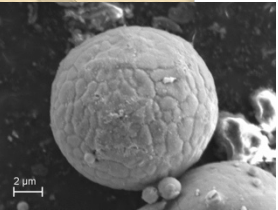
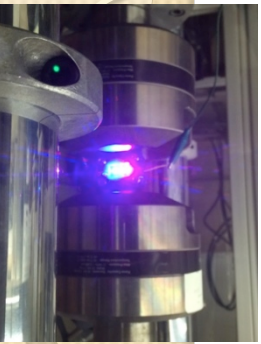
* Projected/Goal



Job Creation



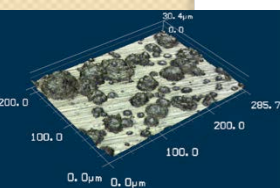
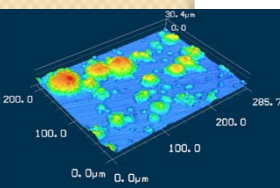
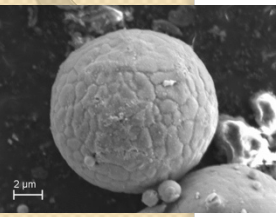
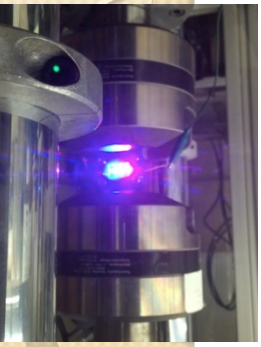
- The center supports a growing number of faculty, students, and researchers, and is adding a fully funded Research Scientist III position later this summer.
- The center has also stimulated 15 salaried positions within SD at VRC Metal Systems.
- The total impact is up 12.5% from last year.



<i>FTE Supported</i>	<i>UG</i>	<i>GRAD</i>	<i>Researcher</i>	<i>Industrial</i>	<i>Total</i>
<i>State Funding</i>	2	3	2		7
<i>University Funding</i>	6	3	2		11
<i>External Funding</i>	10	6	5	15	36
<i>Total</i>	18	12	9	15	54

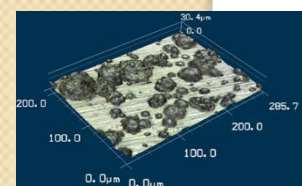
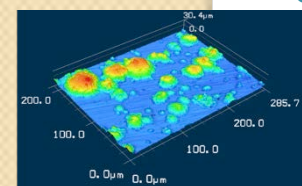
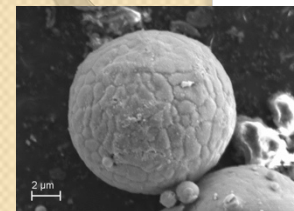
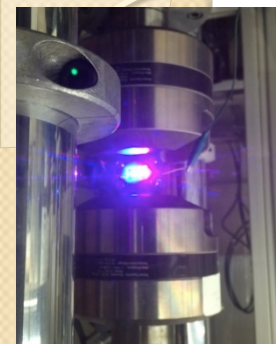
Sustainability

- One STTR and one SBIR proposal were won this year.
- After 1 yr. Frank Kustas will be self-funded, and the planned new hire will be fully funded to start.
- Multiple research areas in development...
- Ellsworth AFB is establishing the **Additive Manufacturing Rapid Repair Facility** which will provide long term opportunities and will bring MOOG to SD.



IP & Commercialization Activity

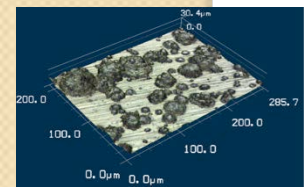
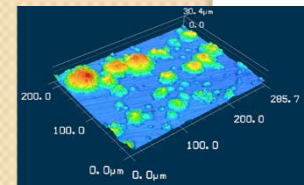
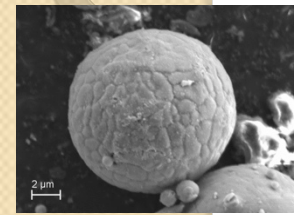
- Governor's Giant Vision 2015 -- 1st place (tie)
- \$25,970 was received for license revenues in FY' 15 for cold spray patents.
 - **[Total Revenues: \$94,320]**
- Expect over \$50K for FY' 16



<i>Frequency</i>	<i>Disclosure/Under Review</i>	<i>Provisional Patent(s) Filed</i>	<i>Patent(s) Issued</i>	<i>License Agreement</i>
<i>Previous Fiscal Years</i>	8	3	0	3
<i>Fiscal Year 2015</i>	2	0	0	0
<i>Total</i>	<i>10</i>	<i>3</i>	<i>0</i>	<i>3</i>

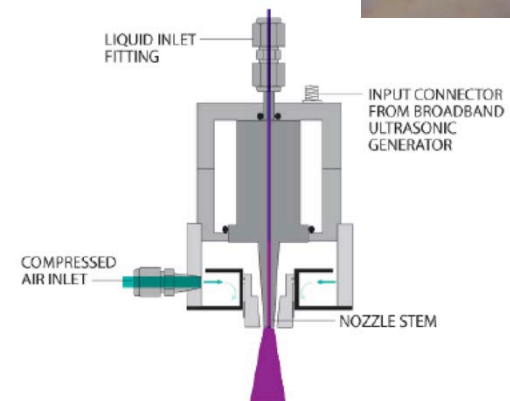
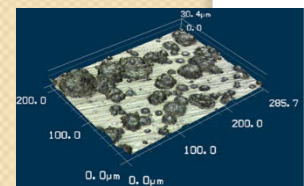
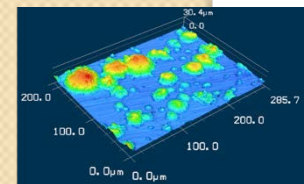
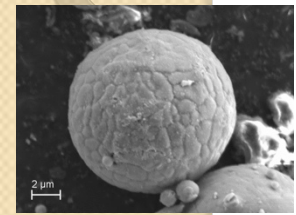
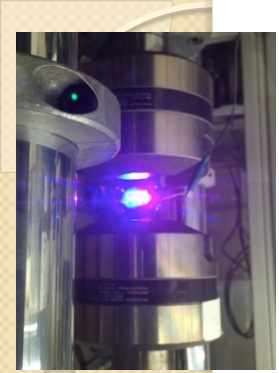
Total FY' 16 Budget Request

<i>Budget Classification</i>	<i>Expenditures</i>
<i>Personnel</i>	
<i>Existing Senior Personnel</i>	\$100,000
<i>Anticipated New Senior Personnel</i>	\$20,000
<i>Post Doctoral Associates</i>	
<i>Graduate Students</i>	\$27,000
<i>Undergraduate students</i>	\$24,000
<i>Technicians/Clerical</i>	\$10,000
<i>Fringe Benefits</i>	\$28,608
<i>Additional Expenditures</i>	
<i>Equipment</i>	\$40,000
<i>Supplies</i>	\$39,000
<i>Travel</i>	\$19,000
<i>Contractual Arrangements</i>	\$83,392
<i>Other (Tuition & Conference Fees)</i>	\$9,000
<i>Total Direct Costs</i>	<i>\$400,000</i>



Ultrasonically-Agitated Air Atomized Nanospray System for Hydrophobic Coatings

- Upgrade to state-of-the-art nozzle spray system for the deposition of nanoparticles to modify surface properties:
 - Enabling technology that prevents agglomeration of nanoparticles, such as boron carbide, graphene, alumina.
- Applications that require super-hydrophobic, icephobic and abrasion-resistant surfaces that resist water, ice-formation and abrasion.
 - Pump shafts and immersion-pump housings
 - Unmanned aerial vehicle (UAV) and ship surfaces
 - Turbine engine blades and aircraft leading edges



Special Project – Budget & Milestones

“Super-Hydrophobic Coatings”

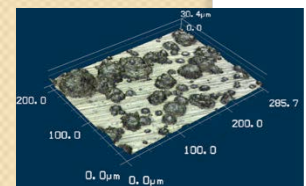
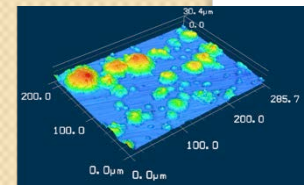
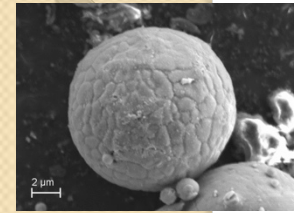
Requested Budget: \$35,000

- Sonotek, Inc. Accumist, Impact nozzle Vortex atomized spray system; ~\$25k
 - Sonic syringe and pump kit w/ Integrated ultrasonic nozzle
 - Base controller package with RF generator
 - \$2K Shipping & Installation
 - \$8K Labor for Initial Process Feasibility Demonstration

Milestones / Outcomes (PI – Dr. Frank Kustas)

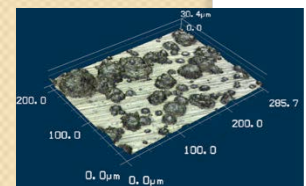
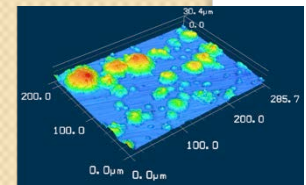
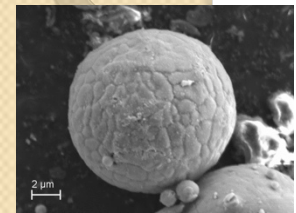
1. Demonstration of spray application of superhydrophobic coatings on engineering materials.
 - 3 months after receipt of equipment
2. Characterization and test of surface properties.
 - 6 months after receipt
3. Briefing(s) to industrial customers (3M, Graco)
 - 8 months after receipt of equipment

Low Risk Anticipated ROI > 10:1



Copper Cold Spray for Electronic Applications [Industry & Investor Identified Project]

- **The NEED:** Low cost “imagable” conductors made of Cu
 - Automotive Glass Defoggers
 - Solar Cells – on silicon wafers
- **The CHALLENGE:** Produce low oxidation Cu traces.
 - In auto defoggers a viable high volume process for applying copper conductors has not been developed.
 - In solar cells a viable high volume alternative to silver is needed.
- **The OPPORTUNITY:** Investors to commercialize have already been identified.



Special Project – Budget & Milestones

“Conductive Copper Traces”

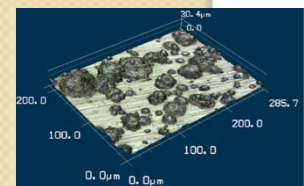
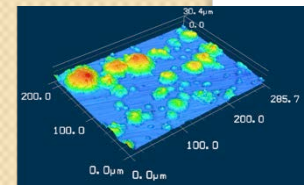
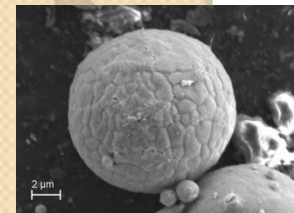
Requested Budget: \$40,000

- Labor - \$24K
 - 2 Staff & 2 Students – 6 week effort
- Materials & Testing - \$16K
 - Inert Gas, Powder, Substrate Material, Test & Equipment Fees

Milestones / Outcomes (Co-PI – Mike Carter)

1. Order & Receive Materials for feasibility study
 - 6 weeks after project award (M. Carter)
2. Process development and characterization and test of trace properties.
 - 4 months after project award (C. Widener & M. Carter)
3. Briefing(s) to EIR board & interested industrial partners
 - 6 months after award (C. Widener)

If successful, Expected ROI > 10:1



Conclusion/Summary

- The AMPTECH center off and running and is well positioned for expanding influence in FY'16.
 - Won competitive Air Force Rapid Innovation Fund - \$2.9M over 2 years – Awarded through HF Webster/VRC Metal Systems.
 - *ARL continuing cold spray research support \$425K for FY'16.*
 - Air Force is establishing an Additive Manufacturing Rapid Repair Facility at Ellsworth AFB as a result of center activities.
 - Growing industrial base of 32 companies.
- Frank Kustas, Ph.D. – [thin film coatings] – After 1 year will achieve Self-Support Status in FY'16.
- *State funding continues to provide a mechanism for strategic relationship building and technology development, as well as the ability to pursue proposals that require matching funds.*

Too Many Good Things Happening to List Them All!

