



# Industrialization Progress and Plans in the Americas

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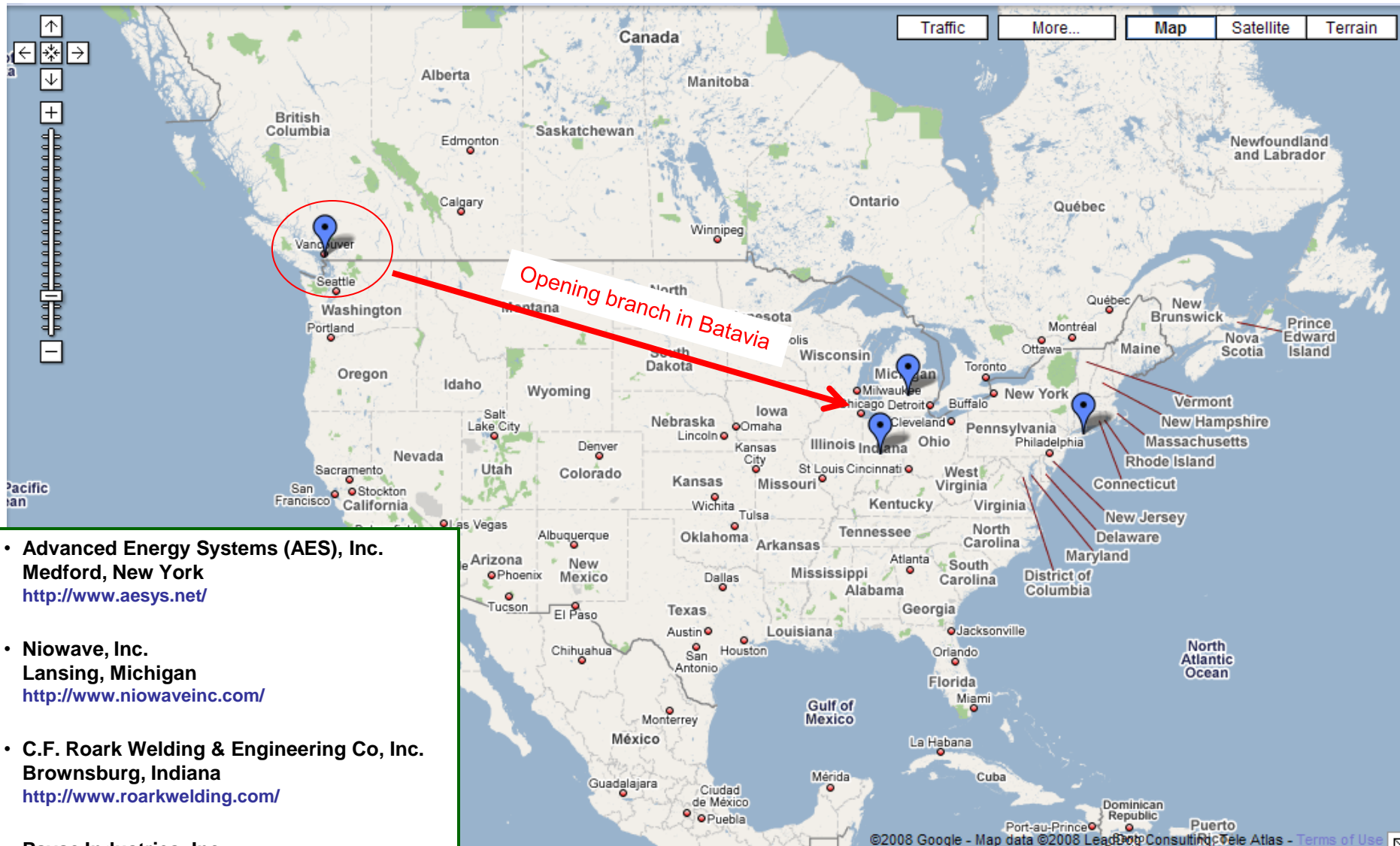
Tony Favale AES IPAC May 2010)

20 October 2010

- Develop SRF Technology in Laboratories, utilizing existing industrial capabilities and further transferring technology to industries when possible
  - Competition
  - Availability
  - Potential Future Capacity
  - Laboratory provides testing, diagnostic, and initial (low volume) infrastructure
- Develop a broad base for future cavity procurements
- Maximize industrial capabilities and capacity to the extent possible with contracts of up to tens of cavities, vacuum vessels, etc



# Cavity Vendors



- **Advanced Energy Systems (AES), Inc.**  
Medford, New York  
<http://www.aesys.net/>
- **Niowave, Inc.**  
Lansing, Michigan  
<http://www.niowaveinc.com/>
- **C.F. Roark Welding & Engineering Co, Inc.**  
Brownsburg, Indiana  
<http://www.roarkwelding.com/>
- **Pavac Industries, Inc.**  
Richmond, British Columbia  
<http://www.pavac.com>



# Cavity Orders

Tesla-shape nine-cell cavities		
Description	No. Cavities	Status
AES 1-4	4	tested
AES 5-10	6	tested
AES 11-16	6	delivered Aug-Sep 2010
AES 17-36	20	Planned deliveries: 10 in Apr-Jun 2011, 10 in Mar-May 2012
Accel 6-9	4	tested
Accel 10-17	8	tested
Accel 18-29	12	testing in progress
Jlab fine-grain 1-2	2	tested
Niowave-Roark 1-6	6	First two received; balance due late 2010
Niowave-Roark 7-16	10	Planned deliveries: 3 in Jun 2011, 3 in Mar 2012; 4 in Dec 2012
Pavac 1-10	10	Planned deliveries: 3 in Jun 2011, 3 in Mar 2012; 4 in Dec 2012
<b>Total</b>	<b>88</b>	
Already Received	44	
Tesla-shape single-cell cavities		
Description	No. Cavities	Status
AES 1-6	6	tested for vendor qualification; currently used for R&D
Accel 1-6	6	tested for vendor qualification; currently used for R&D
Niowave-Roark 1-6	6	tested for vendor qualification; currently used for R&D
Pavac 1-6	6	received summer 2010
Additional R&D cavities	10	out for bid
<b>Total</b>	<b>34</b>	
Already Received	24	



# Vendor Interactions

- Engineer assigned to each vendor
- Vendor visits as needed
- Occasional bilateral meetings with scientific staff for reporting of observations, performance results, and discussion of production techniques
- Frequent vendor contact at conferences and workshops
  - i.e. recent hydroforming meeting at Fermilab, with all North American cavity vendors in attendance



# New Vendor Capabilities

- Whole cavity BCP at AES and Niowave
  - Flow through interior chemistry with adjustable flow rate and temperature
- Horizontal EP development at AES
  - Designed for 1300 MHz ILC cavities and 650 MHz Project X cavities
- Establishment of Pavac US operations in Batavia IL
  - Will include machine shop, pre-weld etching, and EBW



Jlab oven currently used for hydrogen degassing of all Americas Region cavities

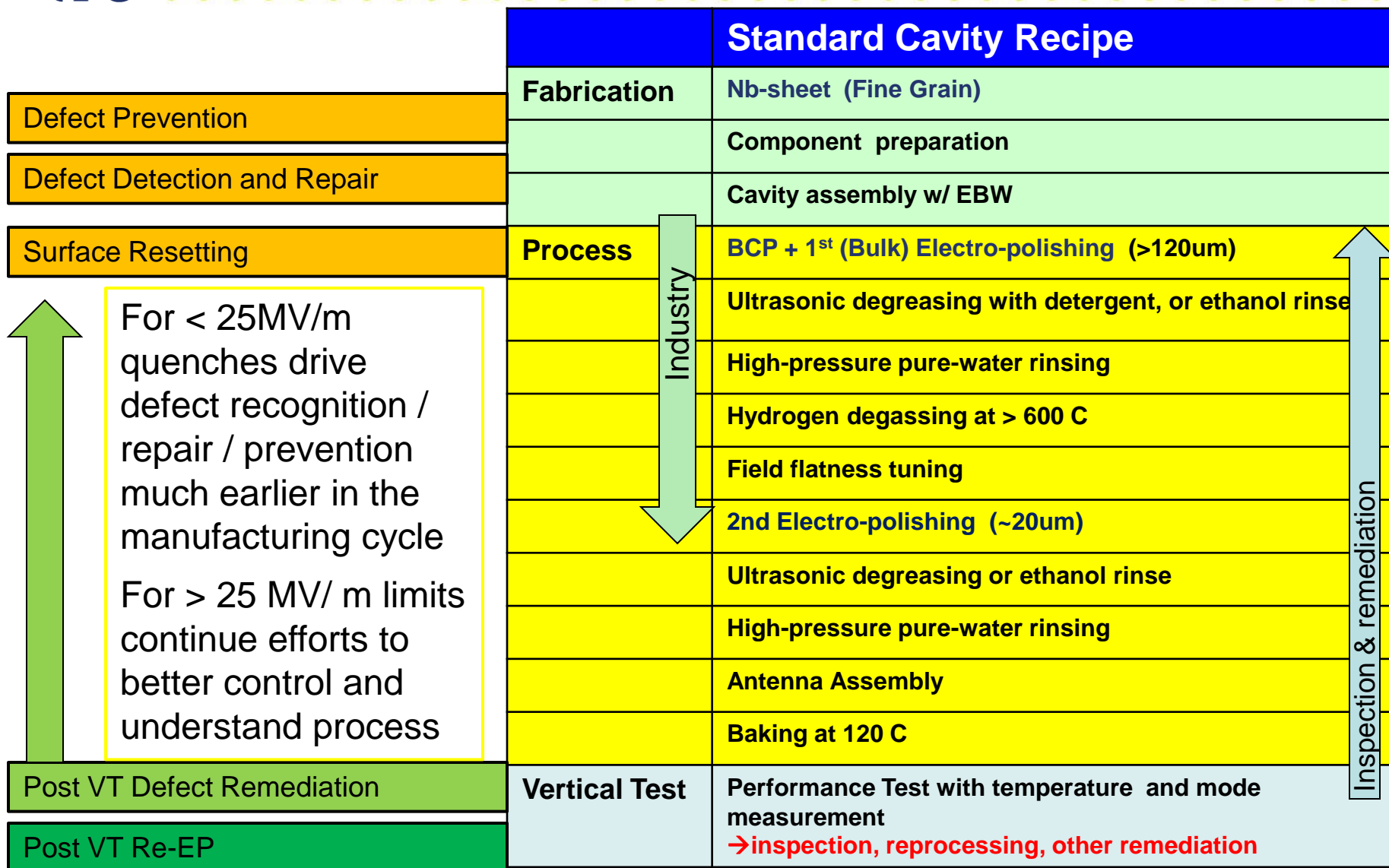


New oven under commissioning at Fermilab

- Cornell has identical on order
- Larger oven due at Fermilab in late 2010



# Industry / Laboratory Partnership







# Hydroforming Activities

- Recrystallized fine grain Nb tube developed by Black Labs LLC and ATI-Wah Chang
  - Uniform microstructure, good for forming, long enough for complete 9-cell
- Two tubes were formed into 2- and 3-cell units at DESY w/ participation from FNAL (winter 2009-2010)
- 9-cell cavity from these components being assembled (@Jlab), will be processed and tested
- Hydroforming summit at Fermilab 1 Sept 2010
  - Nb industry, hydroforming industry, NA cavity vendors present
  - With industry participation formulated a plan for realization of nine-cell cavity hydroforming
  - ILC ART plans to fund in FY11-12



# Cryomodule / RF Procurements

- Strategy notes CM assembly is <10% of cryomodule value
  - Number to be assembled in US in current phase is small
- Design CM at labs, order piece parts / sub assemblies from industry, assemble at Fermilab
  - May not be ILC model
  - CM1-2 from Europe (kit / purchase)
  - CM3-6 US vendors using ARRA funds
- CPI supplying
  - all US couplers
  - three (DESYx2, FNAL NML) 10 MW multi beam klystrons



# Industrialization Studies

- Funded industrial investigations / cost models of
  - ILC RF Unit Industrial Cost Study
  - ILC Cavity Fabrication Optimization for High Quantity Production
  - ILC He Vessel Design for Cost Reduction
- US Industry notes the ILC is a Project, not a Business
  - Limited scope / quantity of follow on work
  - Factory setup costs substantial, may be best born by project
    - Government owned, Industry operated facility suggested
  - LHC model for integrated laboratory / industry partnership to best address risks
- Planning further studies to understand facility and training needs for production ramp up



# Summary

- Americas region efforts focused on utilizing existing industrial skills, and transferring new skills to industry as processes become stable
  - Mitigate risk by spreading knowledge
  - Effort completed through production and test of tens of cavities, fewer cryomodules
- Laboratories host test, diagnostic and R&D/low volume efforts
- Successfully bringing new vendors up to speed in cavity production
- Industries assuming larger role in processing
- Industrial studies continue and will inform ILC production models and R&D efforts