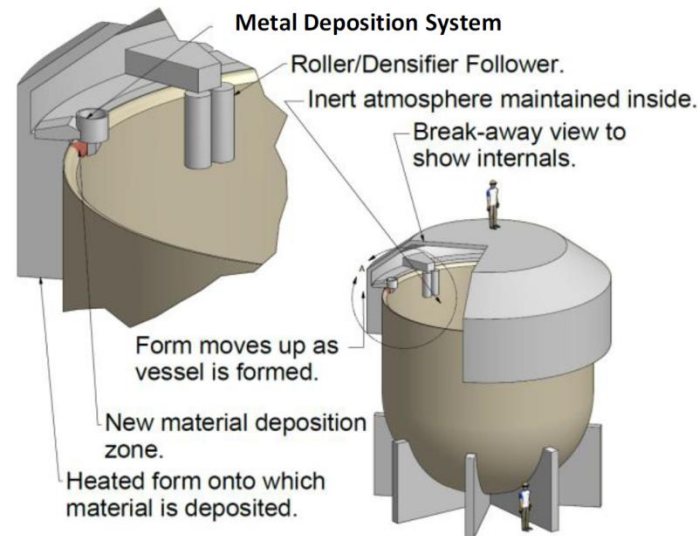


Advanced Onsite Fabrication of Continuous Large-Scale Structures

Corrie I. Nichol, Ph.D.

AMM Workshop

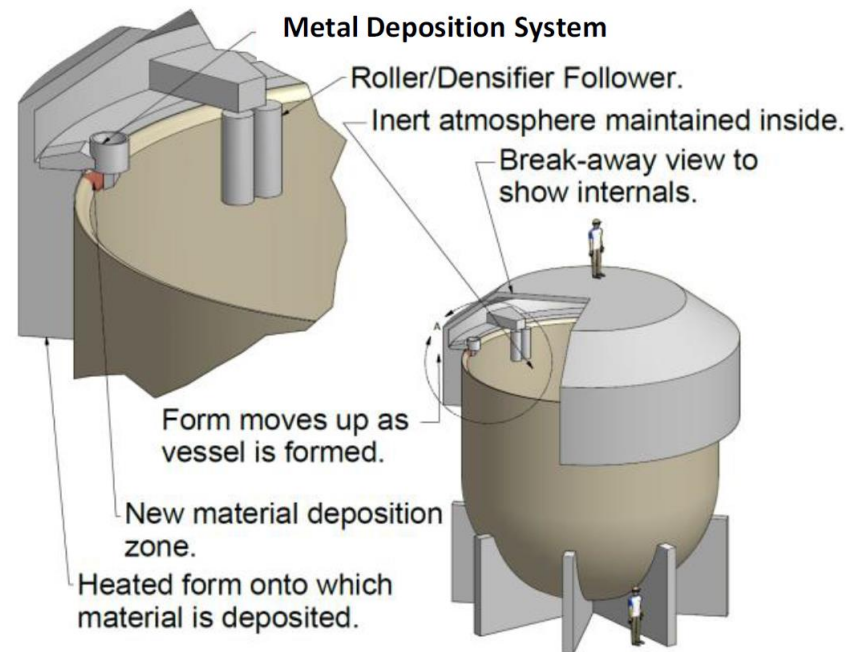
29 Sept., 2015



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Concept Overview

- Cross between 3-D printer and Concrete Slip-Forming
- Structure built on-site from small format raw materials
- Form moves up as vessel is formed
- Material is fully densified by roller follower

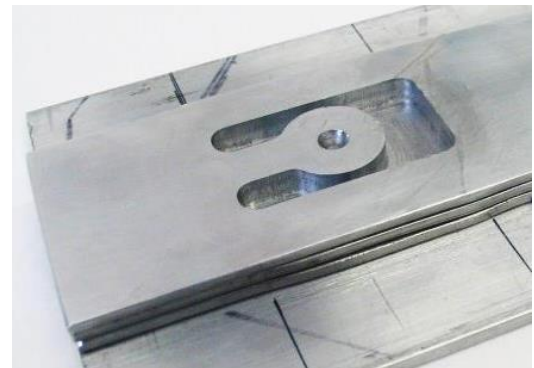
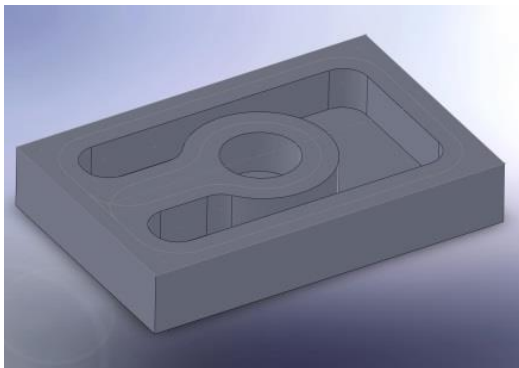
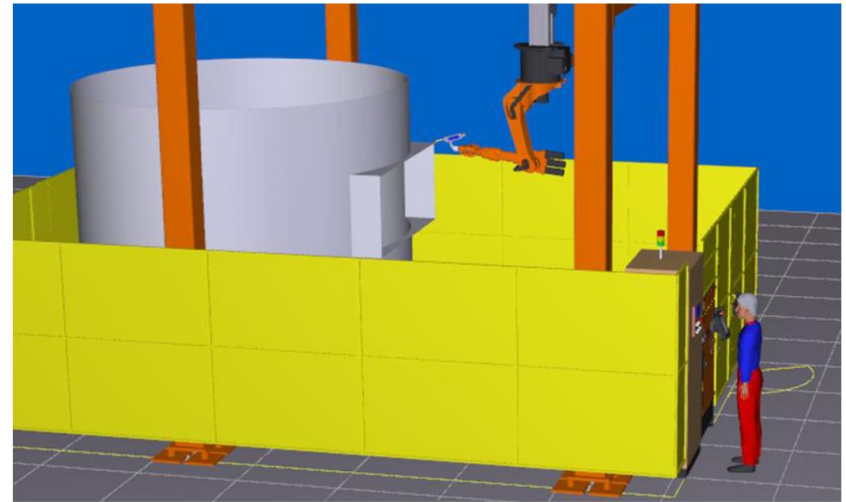


Potential Benefits

- Potential multi-material composite construction, multi stress-state end product.
 - Corrosion resistant cladding, high strength steel alloy interior.
 - Residual compressive stresses to reduce corrosion cracking.
- Material transported to site in small form factor. (No component size site limitations.)
 - Site access to large navigable water-ways for component transport not required.
- Welds largely eliminated.
 - Residual weld stresses/weld flaws eliminated.
 - Weld inspection burden reduced.
- Domestic large vessel fabrication.
 - Ultra-heavy forging companies are no-longer in the U.S.

Participants and Relevant Capabilities

- Dr. Corrie Nichol, INL - Robotics
- Timothy McJunkin, INL - NDE
- Dr. Alan McLelland, NAMRC (UK)
Large Scale RP
- Supporting rapid prototyping processes:
 - Arc-based additive manufacturing process
 - Friction stir additive manufacturing



Project Proof-of-Concept Tasks

- Additive manufacturing processes and specific energy for material deposition.
- Development of robotic spray deposition device.
 - Deposition process control
 - Deposition on heated form
 - Post-deposition deformation and residual stress
- NDE for inspection of deposited materials during/after deposition
 - Elevated temperature environment
- Process modeling for energy consumption, force required for densification step, etc.

Relevance and Outcomes/Impacts

- Fabrication of large-scale structures in new locations.
 - SMR
 - Chemical Processing
- Domestic fabrication of large-scale structures.
- Novel fabrication techniques and material composites for improved vessel performance.
- Advance the state-of-the-art of large-scale advanced manufacturing.

