Advanced Onsite Fabrication of Continuous Large-Scale Structures

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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.
Metal Deposition System

Roller/Densifier Follower.
Inert atmosphere maintained inside.
Break-away view to show internals.

Form moves up as vessel is formed.
New material deposition zone.
Heated form onto which material is deposited.