

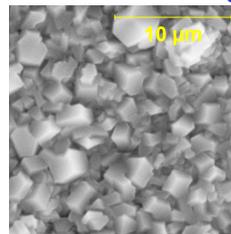
## Long Life, Hydrophilic, Antimicrobial Coating for Condensing Heat Exchangers

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 Proposal No. 10-X3.04-8863

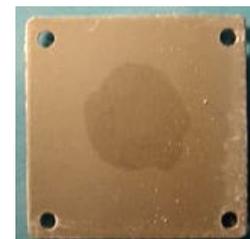
### Identification and Significance of the Innovation

- Condensing heat exchanger (CHX) for ECLSS
  - Creare has developed an adherent, hydrophilic, biocidal coating based on zeolite A (ZA) infused with Ag<sup>+</sup> ions
  - Coating needs features to extend lifetime
- Innovation: Novel coating chemistry/structure extends lifetime
  - Inhibits diffusion/hydrolysis and maintains coating integrity
  - Slower diffusion retains Ag<sup>+</sup>; maintains biocidal properties longer
- Phase I demonstrated feasibility with two candidate coatings
  - Crystalline coatings can be applied to heat exchange surfaces
  - Good adhesion, good wetting, desired crystal structure
  - Demonstrated reduced diffusion through both new coatings
  - Very strong antimicrobial affects initially and after exposure to simulated crew condensate
- Technology Readiness Level:
  - TRL 4 at end of Phase I, TRL 6 at end of Phase II

### Phase I Coating:



Crystalline

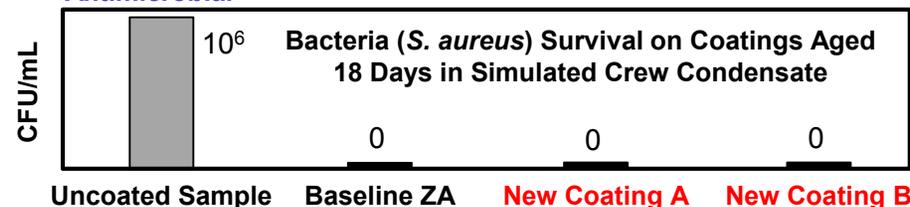


Hydrophilic



Highly Adherent

### Antimicrobial



### Technical Objectives and Phase II Work Plan

- Phase II technical objectives
  - Long life: Goal is >3 year active life extrapolated from Phase II data
  - Stable: Coating intact with minimal downstream scale for >3 years
  - Hydrophilic: 0.5 µm droplet covers 90% of 0.5-in. circle in 90 s
  - Biocidal: At least 3 logs reduction in gram positive bacteria, gram negative bacteria, and fungus throughout active live of coating
  - Prototypical materials: Deposit coatings on stainless steel and braze alloys used for condensing heat exchangers in spacecraft ECLSS
  - Prototypical shapes: Plate-fin geometries for spacecraft ECLSS
- Phase II work plan
  - Refine the two candidate coatings from Phase I
  - Measure candidate performance in long-duration tests
  - Assess and downselect
  - Optimize final coating process
  - Long-duration tests and assessment of final coating
  - Fabricate deliverable CHX

### NASA and Non-NASA Applications

- NASA Applications/Manned Space Exploration
  - ECLSS for manned lunar and/or planetary bases
  - ECLSS for future manned spacecraft
  - Space Station upgrades to replace existing condensing heat exchanger
- Non-NASA applications
  - Water management for fuel cell power systems
  - Hydrophilic coatings for any condensing heat exchanger
  - Biocidal coatings for any water heat transfer surface
  - Coatings for compact heat exchanger/reactors

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NON-PROPRIETARY DATA