

# NASA SBIR/STTR Technologies

X3.03-9108 - A Rapid Coliform Detector



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## Identification and Significance of Innovation

The Rapid Coliform Detector (RCD) is a rapid genetic detector for spaceflight water systems to enable near real-time detection of E. coli with minimal consumables and crew time. The RCD amplifies the genetic material in a liquid sample to allow rapid identification of specific genetic sequences, in this case, that of E. coli. This easy-to-use device incorporates a patented polymerase enzyme that enables rapid RNA amplification by reagents with superior long-term shelf life and thermal stability. To operate, a concentrated water sample is injected into the RCD, where it mixes with the reagent. The RCD is maintained at an elevated temperature for approximately 30 minutes to amplify the genetic material in the sample, which is then applied to a nucleic acid lateral flow (NALF) device that changes color in the presence of specific analyte. In a few minutes, a visual color change (or lack of color change) on the NALF device indicates the presence (or absence) of E. coli in the sample water.

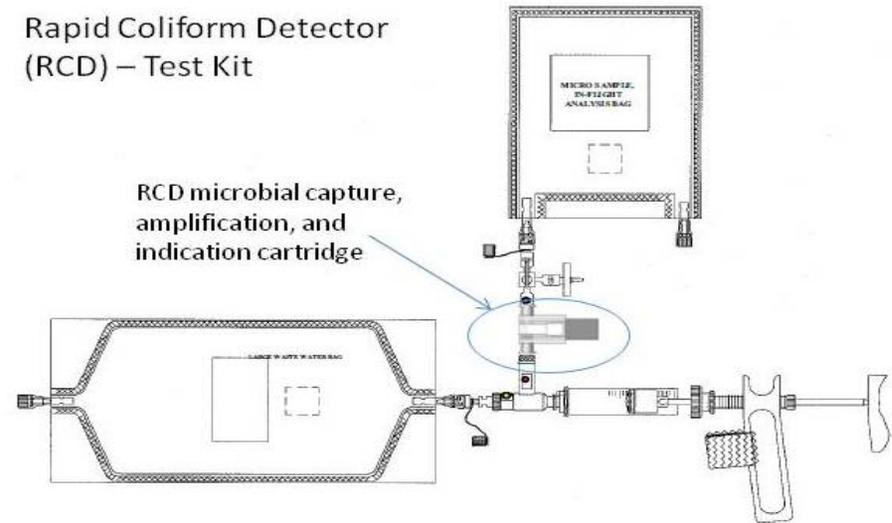
Estimated TRL at beginning and end of contract: ( Begin: 2 End: 4 )

## Technical Objectives and Work Plan

The primary objective of the Phase 1 activity is to develop the chemistry and hardware designs for the Rapid Coliform Detector. This objective will be accomplished through the following tasks:

- Determine mass, power, volume, and interface requirements for an ISS water test kit by investigating details of the current hardware and operations for water storage, sampling, and testing.
- Design the detection system for E. coli rRNA.
- Develop a dehydrated formulation for isothermal amplification.
- Evaluate solid phase extraction (SPE) matrices for ability to remove inhibitors to isothermal RNA amplification.
  - Design and fabricate prototype test kits for rapid detection of E. coli in water, with emphasis on minimizing consumable mass, volume, and crew time.
- Test performance and sensitivity of the prototype test kits by comparing results with standard coliform detection methods.
- Develop a conceptual design of a RCD processing chamber, with emphasis on minimizing mass, power, and volume.

## Rapid Coliform Detector (RCD) – Test Kit



## NASA Applications

The RCD indicates the presence of E. coli in water within 30 minutes of sampling, and reduces consumable mass and crew time over current, much slower detection methods. If an E. coli infection is suspected in space, potential sources can be tested, and results determined quickly, so additional infections can be avoided. This technology can be used on the ISS and on future long-duration spaceflight missions.

## Non-NASA Applications

RCD technology will have a major impact on terrestrial water quality management. Access to field diagnosis of diseases will improve sanitation in resource-limited settings. The technology will promote better understanding of the epidemiology of emerging pandemic pathogens in real-time, will reduce the response time to outbreaks, and could help combat potential future biological threats.

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**NON-PROPRIETARY DATA**