



# **Overview of the NESC Active Thermal Technical Discipline Team**

**Hank Rotter**

**NASA Technical Fellow for Life Support, Active  
Thermal and Fluid Systems**

**NASA Engineering and Safety Center**

**281-483-9249**

**[henry.a.rotter@nasa.gov](mailto:henry.a.rotter@nasa.gov)**

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# Background



**NASA Engineering and Safety Center's (NESC) mission is to perform value-added independent testing, analysis, and assessments of NASA's high-risk projects to ensure safety and mission success. The NESC engages proactively to help NASA avoid future problems.**

**NESC is an independently funded program with a dedicated team of technical experts that provides objective engineering and safety assessments of critical, high-risk projects.**

**NESC is dedicated to promoting safety through engineering excellence, unaffected and unbiased by the programs it is evaluating. The NESC is a resource and is meant to benefit the programs and organizations within the Agency, the Centers, and the people who work there.**

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## Active Thermal Technical Discipline Team (TDT)



<b>Name</b>	<b>Center/Organization</b>	<b>Position</b>
Hank Rotter	LaRC (at JSC/WE)	Active Thermal Technical Fellow
Eugene K. Ungar	JSC	Active Thermal TDT Deputy
Pamela B. Throckmorton	LaRC	Budget Analyst
J. Gary Rankin	JSC	ISS ATCS Lead
Cynthia Cross	JSC	Orion ATCS Lead
Ryan A. Stephan	JSC	Altair /Advance ATCS Lead
Arturo Avila	JPL	Technical Expert
Walter E. Bruce	LaRC	Technical Expert
John R. Sharp	MSFC	Technical Expert
Brian J. Motil	GRC	Technical Expert
Wes Ousley	GSFC	Technical Expert
David G. Gilmore	The Aerospace Corp.	Technical Expert
Bruce Graumann	Boeing Houston	Thermal Analysis
Guadalupe Gonzales	Boeing Houston	ISS ATCS Lead
Robert Rodriguez	USA/KSC	Orbiter ATCS Lead



# Active Thermal Control Scope



- **Heat transport system and temperature controls**
  - Routing the loop heat collection loop with mixing valve temp control
  - Cold fluid to Life Support , warm to Avionics, and hot to others (windows, hatches, cryo gas supply to crew, & hydraulics etc....) and to heat rejection systems/components
- **Heat collection components**
  - Liquid to cabin air heat exchangers
  - Liquid to liquid heat exchangers (internal to external loops)
  - Coldplates
  - Loop tubing thermal shun to component/structure



# Active Thermal Control Scope

- **Heat rejection & sinks components/systems with temp control**
  - Radiators – passive, heat pipes, & heat pumps
  - Evaporators & sublimators systems with temp controls
    - Water, Ammonia, and Halons
  - Passive heat sinks – wax es, Ice, other phase change material; structures
- **Single & two-phase zero-g fluid properties & controls**
  - Phase change at inlet to heat exchangers with temp control and condensed by external heat rejection



# Active Thermal Control Scope



- **Active thermal analysis**
  - Temperature and evaporants balance prediction for mission profiles (Orb 1° error = 35 lbs H<sub>2</sub>O/day error)
    - Heat load and environmental (LLO – hot & cold)
    - Vehicle attitudes
- **Vehicle ground cooling**
  - Ground cooling loop via heat exchanger or thru ATCS
  - Conditioned air flow across or thru vehicle
  - Evaporant feed to vehicle evaporator – Ammonia or Halon



# Active Thermal Control Scope



- **Extravehicular suit cooling**
  - Small coolant loops and light weight
  - Heat rejection usually by evaporants
  
- **Thermal transport fluids**
  - External for low temperatures
  - Internal that is not a toxin for crew
  - Common internal and external loop



# Responsibility

- Participate as active thermal control system experts in multi-discipline independent investigations and other activities;**
- Conduct active thermal control systems assessments;**
- Assign active thermal experts to NESC assessment teams**
- Critically reviewing active thermal control systems-related technical input;**
- Act as a technical resource for the discipline;**
- With NESC Review Board approval, develop approaches to identify, solve and prevent active thermal control systems-related problems throughout the Agency.**



# Stewardship of the Discipline



- **Conduct workshops** and conferences to enhance discipline awareness;
- Build and **maintain the health** of the Active Thermal discipline;
- **Sponsor and support Agency-level standards and specifications**, including core standards;
- Lead NASA Discipline Working Groups;
- Ensure **lessons learned** are identified and incorporated in processes;
- Sponsor and conduct **advanced research** in the Active Thermal discipline;
- Foster NASA participation in **engineering academies**;
- Lead activities promoting **stewardship of the Active Thermal** discipline;
- The TDT will be a **focal point for a Active Thermal Community of Practice**.