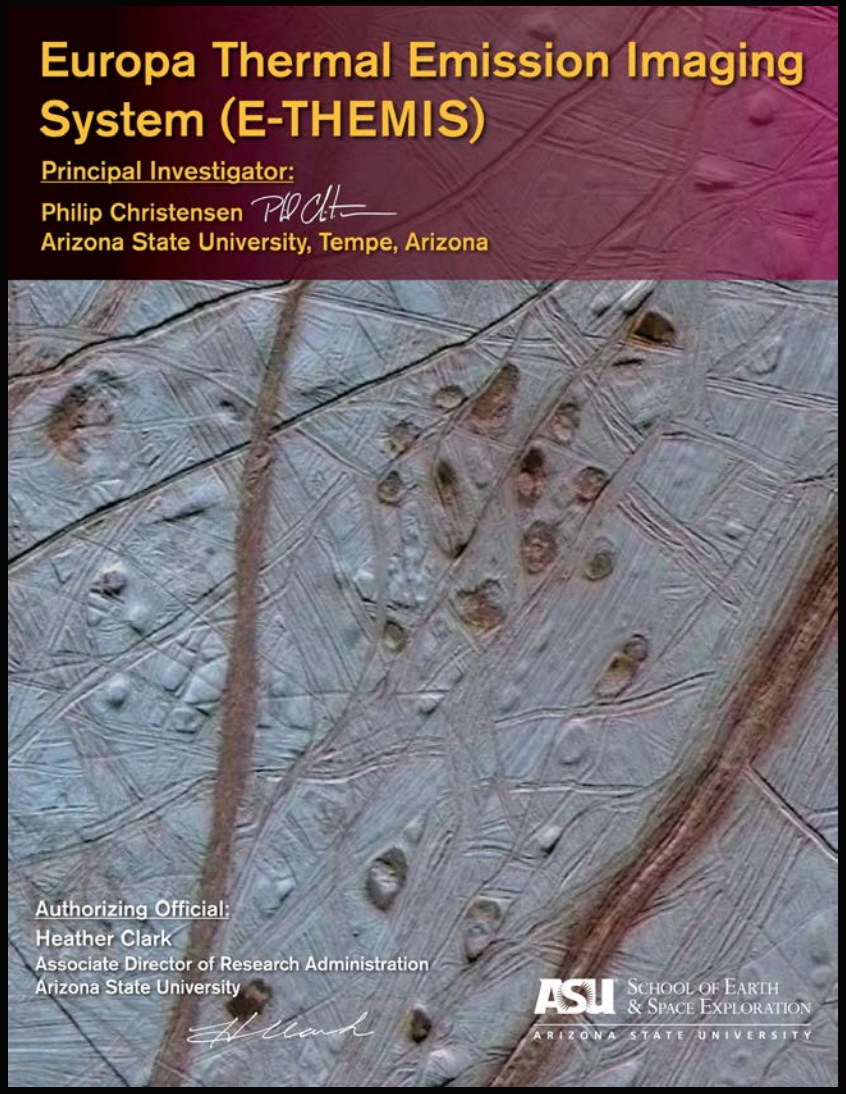


Philip Christensen

OPAG Meeting
August 24, 2015

E-THEMIS Team

- Science Team
  - Phil Christensen
  - Oleg Abramov
  - Francis Nimmo
  - John Spencer
- Project Engineer – Greg Mehall
- Systems engr., opto/mech, test, integration, calibration: Arizona State University
- Electronics: Ball Aerospace
- Microbolometer: Competitive selection

E-THEMIS Science Objectives

1) Detect and characterize thermal anomalies on the surface that may be indicative of recent resurfacing or active venting
2) Identify active plumes
3) Determine the regolith particle size, block abundance, and sub-surface layering for landing site assessment and surface process studies

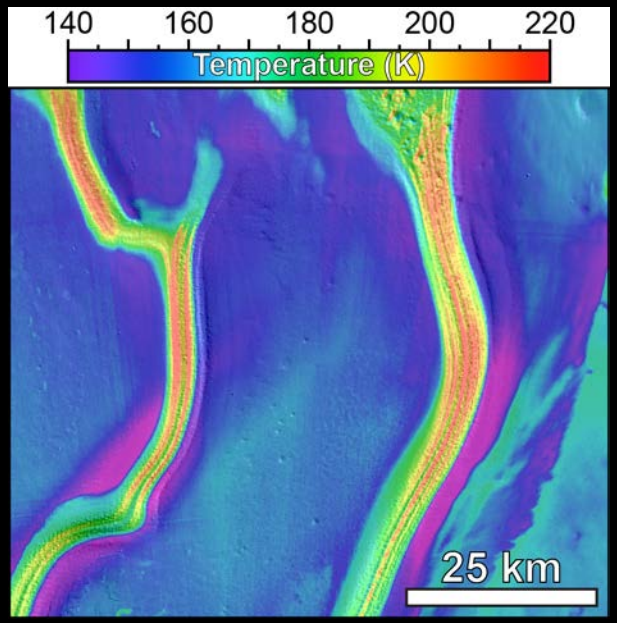
Key Aspects

- E-THEMIS will image the surface at a resolution of 5 x 22 m (including spacecraft motion) from 25 km.
- E-THEMIS will have a precision of 0.2 K for 90 K surfaces and 0.1 K at 220 K, with an accuracy of 1-2.2 K from 220-90 K.
- E-THEMIS will obtain images with up to 360 cross-track pixels with a 10.1 km wide image swath from 100 km.
- E-THEMIS will be built by a partnership of ASU and Ball, combining Ball's expertise in electronics development with the existing ASU flight hardware development personnel, facilities, equipment, and processes.

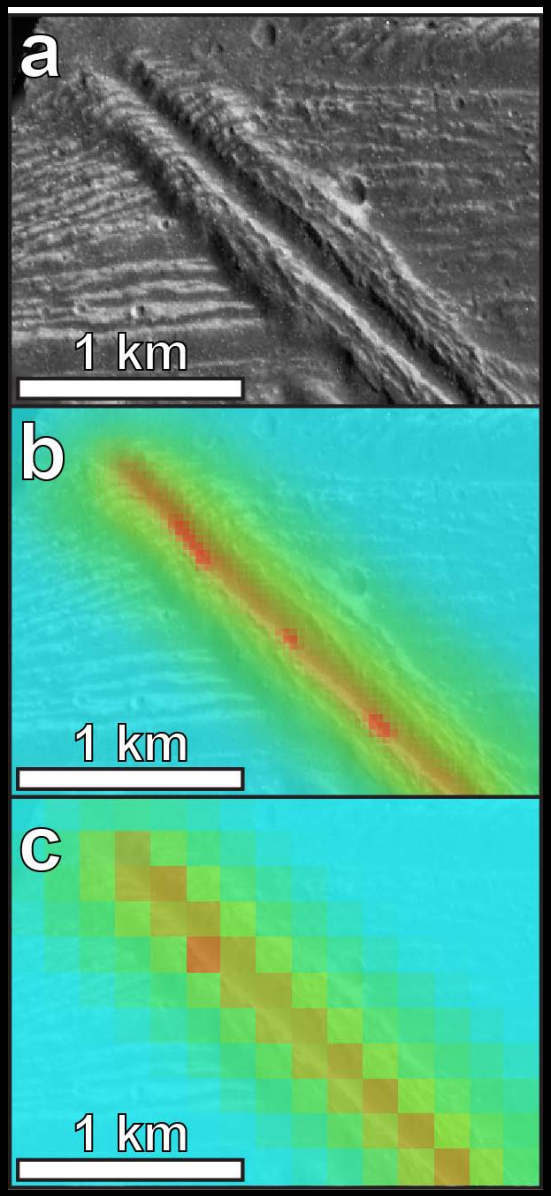
Key Aspects

- The microbolometer detector is inherently radiation tolerant. A radiation-hardened Read Out Integrated Circuit (ROIC) will be incorporated to meet the Europa mission radiation requirements.
- E-THEMIS will build upon the experience gained at ASU in operating the THEMIS infrared imager, utilizing the identical mission operations, data calibration, processing, and archiving team, software, and facility currently used at ASU for THEMIS and the OSIRIS-REx OTES instruments.

Temperature Mapping



THEMIS Mars CO_2 ice cap image

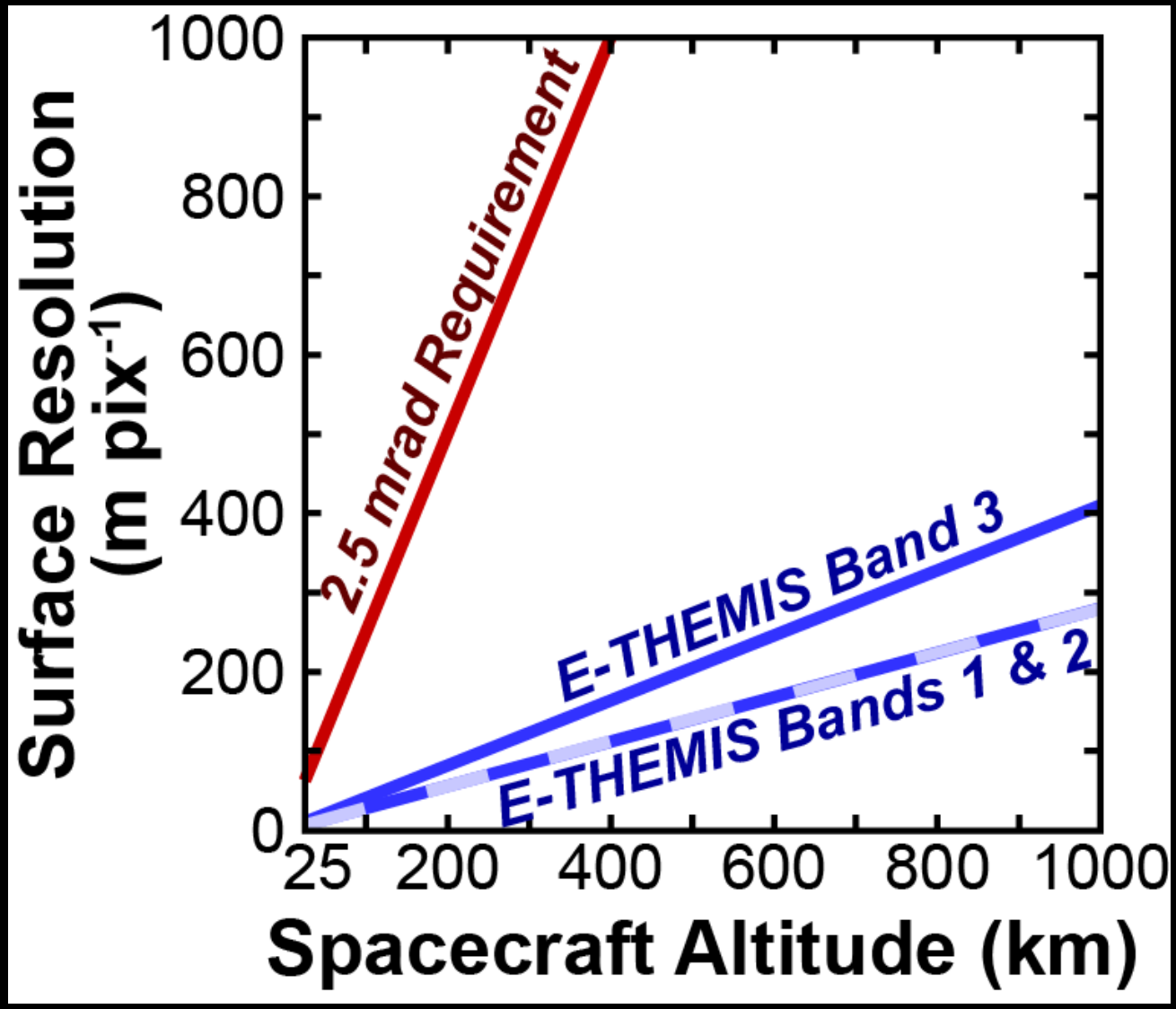


Galileo visible imager with hypothetical temperature measurements at 40 m pix^{-1} (b) and 250 m pix^{-1} (c) resolutions.

E-THEMIS Filters

Band	Spatial Resolution from 100 km Altitude	Scene Temperature (K)	Instrument NETD (K)	Absolute Accuracy (K)
1 (7-14 µm)	17 m x 24 m	220	0.07	2.0
2 (14-28 µm)	25 m x 33 m	130	0.12	2.2
3 (28-70 µm)	46 m x 52 m	90	0.19	1.0

Spatial Resolution



Observing Scenario

Range (km)	V km/sec	Spatial Resolution (km)	# Bands	Image width (km)	Motion per line (km)	Line Rate (sec/line)	% Time Imaging	Data per Interval (In; Mbits)
60,000	4.10	16.800	2	6,048	0.04	4.10	--	--
40,000	4.10	11.200	2	4,032	0.04	2.73	40%	4.0
20,000	4.10	5.600	2	2,016	0.04	1.37	40%	4.0
10,000	4.20	2.800	2	1,008	0.04	0.67	40%	4.0
4,000	4.40	1.120	2	403	0.04	0.25	40%	4.1
1,000	4.40	0.280	2	101	0.04	0.06	75%	8.0
400	4.45	0.112	2	40.3	0.04	0.03	100%	10.9
100	4.55	0.028	3	10.1	0.05	0.01	100%	21.0
25	4.55	0.007	3	2.5	0.05	0.01	100%	59.0
						Total Data Volume (Inbound)		114.8

Anticipated Results

- The E-THEMIS combination of high spatial resolution, large area imaging, and high-precision temperature determination will map temperature anomalies and thermophysical properties to interpret the surface properties and processes.
- E-THEMIS will identify areas of geologically recent resurfacing through the detection of subtle thermal anomalies.
- E-THEMIS will identify active vents at the 1-10 meter-scale.
- E-THEMIS will produce maps of sub-pixel block abundances and identify safe, hazard-free regions for future landed missions.