MARTIAN FLUVIAL LANDFORMS: A THEMIS PERSPECTIVE AFTER ONE YEAR AT MARS. J. W. Rice, Jr.[1], P. R. Christensen[1], S. W. Ruff[1] and J. C. Harris[1], [1]Arizona State University, Department of Geological Sciences, Tempe, AZ 85287-6305. jrice@asu.edu

Introduction: THEMIS (Thermal Emission Imaging System) began mapping operations on February 19, 2002 and is providing both visible and infrared imaging observations of the martian surface at two scales (18 m/p and 100 m/p respectively). IR observations are being conducted during both day and night. IR imagery records temperature variations, which are primarily due to differences in abundances of rocks, indurated materials, sand, and dust on the surface. THEMIS has imaged all of the major outflow channels and valley networks.

Outflow Channels: The source regions for the outflow channels contain large blocks of collapsed chaotic terrain with very coarse (rocky) slopes and talus aprons while the tops of these blocks appear smooth and mantled with finer grained materials (dust) or alternatively the tops of these blocks may be capped by a different material (relatively finer grained than the lower coarser talus producing material). This suggests that the blocks are made of strongly consolidated material capable of eroding into rocky debris. Layering along with cliff and ledge forming members as well as spur and gully morphology is also seen on the chaotic blocks and suggests materials of varying lithologic strengths. THEMIS IR data also indicates that the streamlined islands are composed of pre-existing laterally extensive, layered, weakly consolidated rock. This observation is based upon the fact that the islands do not exhibit coarse talus aprons unlike the chaotic terrain blocks mentioned above. The streamlined islands appear to be primarily erosional landforms and not depositional. No major depositional bedforms (boulder bars, mega ripples, boulder tails) are seen. This observation (lack of depositional bedforms) may be suggesting information on the consolidation and size of sediment transported by the outflow channels. We propose that the overall sediment transported by the floods was derived from layered weakly consolidated materials that break down into relatively fine-grained material that gets washed through the fluvial system. Sediment will flow over longer distances and have lower settling velocities due to the lower acceleration of gravity on Mars. These factors contribute to allowing the sediment to be deposited over very extensive areas and not in discrete sediment packages (bars and fans). It should also be mentioned that MOC imagery does not reveal any depositional bedforms. These observations and interpretations help explain the lack of major depositional bedforms similar to those associated with catastrophic floods on Earth (Channeled Scabland and Iceland). Clearly, coarse material is seen at the Pathfinder site but the large size material (30 cm and up) was transported only short distances 10's of km (Twin Peaks and other knobby outliers and craters). Additionally, younger post diluvial nearby impact craters have also supplied ejecta material to the Pathfinder site. THEMIS imagery has also discovered and mapped two major flows. One is found near the mouth of the northern branch of Kasei Valles. It shows up well in both day and night IR imagery. Ma'adim Vallis has a flow that can be traced over 150 km from its mouth into the floor of Gusev crater. We suggest that these features are hyperconcentrated flows and not lava flows based on their morphology, geologic setting, and lack of nearby volcanic sources.

Gusev Crater: This is a candidate MER landing site and THEMIS is providing new information on this region. Many nearby craters have interior layered deposits that erode into knobs, buttes, mesas and stair step (cliff and ledge) morphologies. A similar morphology is seen on the floor of Gusev especially in the southeast portion of the crater. Here a thick, up to 190 m, deposit is being eroded. We suggest that this material is the remnant of a formerly more extensive unit. Near the base of this unit we see a heavily eroded surface with pits, knobs, buttes and mesas. The knobs have a NW-SE trending fabric forming yardangs. This material is in turn embayed by a smooth plains unit with lobate margins. This smooth plains unit appears to be composed of many thin layers based on the following observations: an ero-

sional window into the material revealing several layers and the shallow mantling of a very small impact crater (the rim can be seen sticking above the unit). The smooth plains material covers most of the landing ellipse with dark aeolian streaks superimposed upon it. These dark streaks are depositional in some locations because they are draped on bright aeolian bedforms. These bright aeolian bedforms then take on a dark appearance in these locations. The bright aeolian bedforms may be granule ripples and/or the remnant of an eroded layer. These features are scattered throughout the ellipse. A 2 km diameter crater is located near the center of the ellipse. An erosional etched pit is located in the smooth plains immediately to the ESE of this crater. The floor of this pit has knobs and buttes similar to that seen in the SE portion of Gusev out of the landing ellipse (described above). This supports the view that this material is stratigraphically below the smooth plains unit. The most recent flow into Gusev was a rumpled looking viscous material emanating from up in the mouth of Ma'adim Vallis. The flow can be traced for over 150 km. This flow is emplaced on top of the smooth plains and is located in the western half of the ellipse. This flow does not show up in the IR indicating that it is mantled with at least a few cm of dust. The Gusev site has been suggested to have contained a paleolake. If indeed a lake formed here then we feel that it is very possible that the lake sediments may have been primarily eroded away or buried. Making it difficult to sample and identify with the Athena payload. It may be possible that impact craters have dredged up these putative deposits. The following craters are either in the ellipse or very nearby and will provide samples from the subsurface: Crivitz is 6 km diam. and 140 m deep, three smaller unnamed crater in the ellipse are 2 to 3 km diam and 35 to 60 m deep. Other large craters 30 to 86 km diam located around Gusev are likely to have contributed material to the floor of Gusev. Additionally, Apollinaris Patera located only 300 km away is very likely to have dumped ash into Gusev.

Valley Networks: Valley Networks have also been imaged with THEMIS. The following observations have been noted. Narrow, incised, discontinuous inner channels with finer grained materials seen on the floors of many valley networks such as Bahram and Nanedi Valles. Stripped channel floors suggesting exhumation of the channel. Valley network dissection also appears much more prevalent in some regions (Libya Montes) than has ever been seen before. This suggests prolonged fluvial activity. Fluvial deposits are also seen at the mouths of many valley networks such as Samara Vallis and an unnamed channel. These terminal deposits are interpreted to be fans.