ENCELADUS' JETS: PARTICLE CHARACTERISTICS, SURFACE SOURCE LOCATIONS, TEMPORAL VARIABILITY, AND CORRELATIONS WITH THERMAL HOT SPOTS.

C. Porco[1], J. Spitale[1], C. Mitchell[1], L. Dones[2], A. Ingersoll[3] , R.West[4]. [1]CICLOPS, Space Science Institute, 4750 Walnut St., Boulder, CO 80301, [3]Southwest Research Institute, Boulder, CO 80302, [3]Division of Geological and Planetary Sciences, Caltech, Pasadena, CA 91125. [4]Jet Propulsion Laboratory, Caltech, 4800 Oak Grove Drive, Pasadena, CA 91109.

Introduction: Cassini ISS images of Enceladus have revealed about a dozen jets emerging from the south polar terrain (SPT) of Enceladus and feeding a giant plume that extends hundreds of kilometers into space [1]. Cassini CIRS infrared observations have also shown the SPT to be anomalously warm [2], and the comparison of high resolution images of the SPT with the highest resolution thermal measurements have shown a coincidence between the hottest measured temperatures in the SPT and the `tiger stripe' fractures which straddle the region [1,2].

It has been suggested that sources of the jets may be sub-surface reservoirs of liquid water, akin in eruptive style to Yellowstone geysers [1], but recently an alternate model involving the explosive release of CO_2 clathrate ices has been proposed [2]. In either case, to produce individual localized jets as observed, the vapor and icy particles in them must be arising from localized regions significantly warmer than the background temperatures of the SPT.

Many properties of the jets are still unknown or under investigation. First, neither the source locations of individual jets nor any association between these source locations and thermal hot spots has yet been carefully determined. Second, one characteristic of the jets that may help constrain the source mechanism and jet dynamics is the particle size distribution and its variation with altitude, and this has not hitherto been modeled in ISS images. Third, no attempt has yet been made to assess temporal variability in the observed jets.

We report here results and work in progress on the (i) determination of the surface source locations of the observed jets by triangulation using images of the jets taken from different viewing angles, (ii) attempts to correlate the jets with the observed thermal hot spots in the south polar region [2], (iii) determination of the jets' particle size distribution and its variation with altitude above the south pole as seen in ISS images, and (iv) the jets' temporal behavior.

Results: We have found that three of the prominent jets observed in the period 2005/2006 have their sources in the Baghdad and Damascus fractures. Two of these are coincident, or nearly so, with the two hottest observed thermal spots (ie, with T ~ 150K), and the third has its source in a region not measured by the CIRS instrument. These results confirm the suspicion that the `tiger stripe' fractures are the sources of the jets, and that the jets are arising from regions that are significantly warmer than their surroundings. They also imply that the activity of individual jets is ongoing on timescales of order at least a year, though variations in strength may be present. Temporal variability in the strength of the jetting activity and possible correlations with Enceladus' orbital position will be examined.

Determination of the particle sizes and their variation with altitude in these jets involves precise measurements of the plume brightness profile which in turn requires careful photometric calibration and subtraction of the background E ring from ISS plume images. Special techniques have been devised for these data reductions, and photometric and particle size distribution modeling is now underway. These results will also be reported.

References: [1] Porco, C. et al. 2006. *Science* **311**, 1393-1401 ; [2] Spencer, J. et al. 2006, *Science* **311**, 1401-1405 ; [3] Keiffer, S. et al. 2006, *Science* **314**, 1764-1766,