STS-48: Debunking Kasher's Five "Can't-Be-Ice" Proofs
Updated/corrected March 22, 2012 [based on 1999 Purdue U presentation]

Dr. Jack Kasher's 1994 paper [http://www.nicap.org/muj_kasher_sts48.htm] presented five "proofs" that the video could not be showing small close objects. Each one of the proofs can be shown to be erroneous. Elsewhere I have laid out the positive argument about why the observed behavior is consistent with entirely-prosaic shuttle-shed ice, hit by a thruster plume.

Proof 1: During the approximately one second interval when the object's horizontal motion is changing from leftwards to rightwards, it stops for a few tenths of a second before resuming the change in motion. It is two or three pixels off from where a smooth curve would have moved it. This, Kasher argues, must be deliberate and cannot be natural.

Disproof: Setting aside Kasher's presumption that the object was able to deliberately align its stopping in precisely the vertical axis of the Orbiter TV camera's field of view, the measurements of vertical screen position elsewhere on the chart show a random scatter of several pixels. By placing a properly-sized error bar on each raw reading, a smooth curve would easily pass through the sequence of points with no zero-motion except instantaneously. The 'stopping' is an illusion of over-accurate data points.

Jeff Sainio adds: "The data shown are very noisy.... The expected curve for an accelerated ice particle would be a parabolic path. The initial part of a parabola is quite flat, and the data are not shown to be significantly different than the expected parabola."

Proof 2: The two fast-moving particles must have been traveling directly away from the RCS thruster. Their motion is linear – "If a rocket did the firing, the lines MUST meet" – and Kasher claims they don't. Kasher's 'Appendix J' asserted that only the left-firing left pod vernier jet (L5L) could possible affect the particle motion – "This is crucial when we examine the trajectories of the objects more carefully."

He wrote: "If they were ice particles accelerated by the one possible vernier rocket, the two lines must meet at one point. This proves that the two objects were not ice particles accelerated by the vernier adjustor rocket."

Disproof: Kasher incorrectly ASSUMES that all thruster plume force is linearly directed away from the thruster. But he misidentified the thruster responsible for the plume puff – it was actually L5D, the down-firing vernier jet, as shown by telemetry records. He was

also unaware of the propensity of aft-mounted down-firing thrusters to generate plume flows which significantly impinged on Orbiter structure and thus bounced off in new directions, including into areas previously out of direct ;sight' of the thruster – such as the region the particles presumably were drifting.

Proof 3: Any particle in the thruster plume would be accelerated nearly to plume velocity, at least 98%. Kasher's 'Appendix B' (see below) proves this, and since the main object was NOT accelerated to this speed by the thruster firing (which Kasher claims lasted 0.4 seconds, as measured by the duration of the pulse), it could not have been a particle.

Disproof: I'll deal in detail with Kasher's 'Appendix B' shortly, but in general the velocity induced on drifting particles depends on how far off the plume centerline they are, and how long the thruster fires. Since the low limit for particle acceleration is clearly zero (as seen by several particles in the video), there must be a range of from zero up to full plume velocity, dependent on factors not measured by Kasher.

In an email to Kasher , Sainio made this observation: "Although you don't state it directly, you appear to base your argument on the correctness of the exhaust-acceleration theory. But this contradicts your conclusion that 'they were spacecraft out in space away from the shuttle'' and obviously not accelerated by a mere thruster. This appears to be an inadvertent reductio ad absurdum argument. If it is exhaust-acceleration, your conclusion is wrong. If not, then the arguments leading up to your conclusion are wrong, and your conclusion is unsupported. No conclusion can be inconsistent with the arguments leading up to it." In other words, Kasher claimed to prove that the motion could not be caused by thruster exhaust, but the proof required assuming that it WAS caused by thruster exhaust.

Proof 4: The main object remained at rest for about half a second during the period of the main flash (following a shorter pre-flash earlier), and then accelerated sharply. "Presumably this was the time the rocket exhaust was moving through vacuum up to the 'ice particle'". If it were ice, it would have been a lot closer to the thruster, so the half second delay is too long for the fast-moving exhaust, and it must have been much farther away.

Disproof: This argument is based on Kasher's misunderstanding of the nature of the flash, which he assumed was the entire thruster firing. Actually, the flashes were brief interludes within the full thruster firing of about 1.2 seconds when throat-clearing or brief propellant ratio mismatch led to a visible flow in the normally invisible plume.

Sainio agrees: "Presumptions are dangerous to proofs. As the flash is known not to correspond to the thruster firing, this proof fails."

Proof 5: Since any particle hit by a thruster exhaust would have to reach a speed of 8300 ft/sec, it would be too far away at the end of the thruster firing to be visible.

Disproof: This depends on 'Appendix B', where Kasher attempts to prove that a particle entrained in a thruster plume will be accelerated to nearly the full plume velocity. He uses mathematics to show that this is exactly what happened with the main object in the video. But Kasher seems to have made a math error in which the acceleration is independent of the mass of the particle and the density of the plume [which varies with the angle off centerline] – a grade-school howler so obviously at variance with reality that no real physics expert would even imagine it could be true..

Sainio: "The 1.7 second acceleration time is flatly contradicted by the raw data it is based on.... [It] is not shown to be anything more than an artifact of the heavy smoothing used in the curve-fit, and is not shown to be a better fit than a simple 1-second linear acceleration due to a 1-second vernier firing which occurred at the time of the event. Practically any curve-fit of a sloped line connected to a flat line will 'round out' the end of the slope and make the slope resemble an exponential curve."