March 14, 1999

When assessing Dr. Carlotto's work on STS-48, be sure to have both of his papers, the original in JSR (Vol. 9, No. 1) and the subsequent response to criticisms from referee Irwin Wieder in which in light of new evidence he modifies or retracts some of his conclusions. Many authors (e.g., Strieber) quote 'conclusions' from the first paper which were abandoned in the second -- bad form, if not deliberately deceptive (ho hum!).

Carlotto identifies two of the stars as Errai and Polaris, and correctly points out that the Sun on that date was about 87 degrees from Polaris. But curiously he overlooks his correct assessment elsewhere that the horizontal FOV of the camera was about 40 degrees wide (consistent with Shuttle technical manuals I've checked), and since the stars are to the right of the center of the screen, they are far off to the side of the shuttle's track.

In fact, from knowledge of the shuttle's orbital inclination alone (57 degrees), Polaris would have been about 30 degrees off to the side, looking straight backwards. However, Carlotto's illustration (figure 4, 'Relations between Shuttle, Polaris, and Sun', page 48) incorrectly shows the shuttle's Z-axis (the up-down axis, where X is from tail to nose and Y is from left wing to right wing) pointing almost directly at Polaris. It was actually pointing about 10 degrees to the right of the ground track and hence about 20 degrees to the LEFT of Polaris.

The incorrect drawing leads Carlotto and his readers to imagine post-sunrise sunlight streaming over the nose of the shuttle and filling all the space above it, leaving no space for a particle to be in the shuttle's shadow and then appear.

This is what he is discussing with figure 14 on page 57, when he says: "The brightening in the upper left is caused by an increase in scattered light from the right side of the camera lens. Thus when M1 appears in the video, the shuttle is in daylight with the sun to the right. M1 is downtrack from the shuttle and thus cannot be emerging from its shadow. It is thus unlikely that M1 is near the shuttle since there is no mechanism to explain its appearance."

Fortunately, unlike Carlotto, we now have the technical data on the shuttle's actual orientation during this interval and can see that Carlotto's guessed orientation is seriously in error (as can be determined even with internal evidence in his paper). At sunrise, with Polaris 30 degrees to the right of downtrack (and near the center of the camera's FOV) and the Sun another 90 degrees farther right, we see that the line to the Sun is not directly out the nose, as Carlotto argues, but 30 degrees below the nose. Even a minute later, with only 4 degrees of motion relative to the celestial sphere, the sun is still casting a large volume of shade into the areas above the shuttle aft end and wings.

Hence Carlotto's conclusion that there is no shaded region within the camera's FOV is erroneous, and his consequent elimination of a nearby particle explanation is faulty.

Now, what IS the brightening Carlotto interprets as scattered light at sunrise? I think it's scattered light at sunrise, since it appears simultaneously with the first three dots (one of which, Ratsch-5, makes a course change eighty seconds later simultaneously with the flash). This upper left corner glare remains unchanged even later as the camera tilts down and pans right, which suggests it is indeed scattered sunlight from some illuminated portion of the shuttle structure. Whatever the source of indirect light, it -- like the thruster flash -- is only barely visible to the super-sensitive camera optics and is in itself too dim to illuminate small nearby objects -- only direct sunlight is bright enough.

Carlotto also overlooks the angular size of the Sun. In another argument against the ice particle theory, he observes: "Instead of changing abruptly as one would expect of an ice particle near the shuttle passing from shadow into sunlight, the brightness increases gradually over a 1 second period". This is only true, of course, for a point source of illumination; the particle moves through a region where it is lit at first only by a sliver of the sun, then by half the sun, then by all of it, so naturally it would brighten over a finite period of time rather than instantaneously. At a range of, say, 60 ft from the shuttle structure casting the shadow, that distance of gradual brightening would be about half a foot, which is quite a reasonable (and typical) distance for an ice particle to cover in one second.

There are other errors that grab one's attention. Carlotto writes: "Prior to the flash mentioned earlier, the object slows and seems to stop. After the flash it changes directions." But as Kasher's analysis shows (chart was scanned and emailed a few weeks ago), the 'slowing' begins coincident with the "pre-flare" (Kasher's term) and continues through the end of the main flare (that is, for the entire duration of the burn, some of which didn't flare); there is no pre-flash change in the object's motion. This is quite careless of Carlotto. The change in motion of all particles on the screen coincides with and only with the thruster firing.

Carlotto also argued that the lack of observed background motion after the flash proved it was not a thruster firing. He retracted this assertion in the follow-on exchange with Dr. Wieder, once actual telemetry records were available (he made excuses for not seeking those records, saying it was somebody else's responsibility to give the records to him).