THE GREAT STS-48 ZIG-ZAG UFO
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March 31, 1999
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Mission Description:
'Discovery' 13th flight
Deploy UARS -- Upper Atmosphere Research Satellite
Launch 1991 Sep 12 at 23:11 GMT
Inclination 57 degrees, altitude 570 km
Duration 5 days 8 hrs 27 min
Crew: Creighton, Reightler, Gemar, Brown, Buchli
Famous Videotape of "Zig-zag"

Event occurred about half an hour after crew wakeup, during "post-sleep activities" (stow sleeping bags, line up for the head, read overnight faxes and email, eat breakfast, shave, wash, etc.)

Videotaped by Donald Ratsch, UFO buff in Maryland

Ratsch sent letters (Oct 18) to his congressmen demanding investigation
Congressmen forwarded request to NASA (Oct 22)

NASA replied (November 1991): "The objects seen are Orbiter-generated debris, illuminated by the sun.... The flicker of light is the result of the firing of the attitude thrusters on the Orbiter, and the abrupt motions of the particles result from the impact of gas jets from the thrusters."

-- Subsequently appeared on numerous television shows (Sightings, Hard copy, NBC)
-- Technical studies by Dr. Jack Kasher and Dr. Mark Carlotto
-- Videotape for sale by Richard Hoagland, others
-- At least two dozen web sites devoted to the event
-- Endorsed in numerous books (Strieber, Randle, etc.)
-- Ignored by 'National Enquirer'
-- Broad consensus that event is unexplainable; no dissent within UFO community
-- NASA explanations derided ('Urine dump', ha! Coverup, aha! Saucer-shaped!!!)
#2 (M1) appears; all others are in view for entire period most often shown.

Path was actually a bit below the horizon.

This object may turn out to be the key to the puzzle.

Note: Six different dots change course simultaneously with flash - and no other changes at any other time.

Plot of Particle Motions
From Dr. Jack Kashner's study (1994)

- Note: Interval of change in rate is longer than just the flashes and seems about 1.1-1.3 seconds.
- Rate drop off probably due to distance.
- Note 'bumpy' data as pixels jump +/- 2-3 counts.

Kashner interprets this straight line as proof the object fully stopped relative to the orientation of the active camera. But the straight line is only 2-3 pixels different from a smooth curve—"noise level."
AS PRESENTED, A GENUINELY AMAZING & UNEXPLAINABLE EVENT.

Source of mystery and fascination:
Unique combination of events each known to often occur singly

White Dots in B&W (Low-Light) Camera --
Can be lit by sun or by payload bay lights (if on, e.g., during rendezvous)
Most often seen with iris wide open

Sudden appearance of one (near horizon)
Dots often appear at sunrise when some drift out of shuttle shadow
Dots can appear randomly against Earth or black sky

Flash and change of direction -- more rare

Streaks by particles exiting thrusters -- fairly common

Each known to occur in shuttle videos, but combination unique

SO SEQUENCE IS HIGHLY UNUSUAL, BUT ARE EACH INDIVIDUAL FEATURE EXPLAINABLE OR NOT?
Eyewitness Testimony

NASA reply to congressman's letter (November 1991), after review by Bill Pitts, Joe Loftus, and astronaut Karl Henize: "The objects seen are Orbiter-generated debris, illuminated by the sun.... The flicker of light is the result of the firing of the attitude thrusters on the Orbiter, and the abrupt motions of the particles result from the impact of gas jets from the thrusters."

Otha "Skeet" Vaughan, principal investigator of lightning observation experiment, who has collected and studied more than 500 hours of low-light night views of Earth: "They're an ordinary part of space flight," he says. "It's obviously just more shuttle debris."

STS-48 astronaut Mark Brown says ice formed on the shuttle's main engine bells after the remaining fuel was dumped in space. "These crystals would break free of the engines and float around the shuttle," he says. "When illuminated by sunlight they looked like small diamonds floating in space, disturbed only when the maneuvering rockets fired — the plumes from the rockets would hit them and send them off in different directions."

STS-48 co-pilot Ken Reightler says: "We saw a lot of this on STS-48 because we had a dump nozzle that was leaking." The same nozzle leaked on the shuttle's next mission and "created the same shower of ice particles — but this time apparently no one misinterpreted them as UFOs."

As a rule, to give appearance of balance, TV shows use uninformed "NASA spokesmen" who are unfamiliar with the event to present off-the-cuff suggestions that wind up sounding lame and silly (e.g., Buzz Aldrin on NBC)

*POINT: UFO PROGRAMS AVOID PRIMARY WITNESSES, QUOTE OFF-THE-CUFF GUESSES IN ORDER TO DISCREDIT EXPLANATIONS*
SPACE FLIGHT VERY DIFFERENT FROM AIR FLIGHT

Particles (usually ice) near manned spacecraft common

* 1962 John Glenn's "fireflies" (ice from flash evaporator)

* 1960s X-15 flights (ice from outside of LOX tank)

* 1965 Frank Borman's "bogie" (Gemini-7), booster debris

* 1969 Flashing lights on way to moon (SLA panels)

* 1970 "Moon Pigeons" report to assess particles as indicators of spacecraft anomalies (venting, insulation flaking, pyro sep debris)

* 1980s Space Shuttle (flash evaporator ice, waste/supply water dumps, thruster propellant leakage, main engine LO2/LH2 dumps, payload bay debris, tile liner strips, insulation blanket fragments, dropped EVA tools, debris from payload deployments, etc.)

Not widely appreciated by public that objects near spacecraft will drift along with them in orbit at more-or-less same velocity and flight path

MOTION IS COUNTERINTUITIVE, UNEARTHLY
44 "RCS JETS", TWO VALVES IN EACH

MAIN ENGINES DUMP EXCESS LOX & LH2 AFTER REACHING ORBIT

ICE BUILDUP ONCE ON TOP OF DOOR, THAT SURVIVED REENTRY

FIGURE 5: PLAN VIEW OF SHUTTLE VENT LOCATIONS
THRUSTER CHARACTERISTICS

"REACTION CONTROL SYSTEM" -- RCS
Hypergolic (self-igniting) propellants, 1.6:1 ratio
oxygen: Nitrogen tetroxide
fuel: monomethyl hydrazine

Along with water, will freeze in vacuum from evaporative cooling

Three independent pods -- forward, right, and left.

Firing duration:
80 millisecond pulses or steady state (1-125 sec)

Two types -- PRIMARY and VERNIER

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"POWER" "ECONOMY & GENTLENESS"

Control: with joystick or by autopilot

Can either go to defined attitude or hold current attitude within allowable error ("DEADBAND")
SHUTTLE'S 44 JET LOCATIONS

NOTE: OMS/RCS PLUMES ARE
GENERALY INVISIBLE EXCEPT
WHEN MIXTURE RATIO IS OFF NOMINAL.
VISIBLE FLARES ARE ONLY SMALL PORTION
OF TOTAL ENGINE FIRING INTERVALS.
RCS JET PLUME IN VACUUM OR SPACE

THE AMOUNT OF OFF-CENTERLINE SPREAD IS SURPRISING TO GENERAL PUBLIC - EXPANDS FROM NOZZLE AND FROM WITHIN PLUME!

SOME EVEN LEAKS AROUND THE CORNER

FIGURE 4.3.5 Dynamic Pressure (lbf/ft²) Contours in the RCS Engine Plume (Continuum and Free Molecular regimes)

DYNAMIC PRESSURE vs RCS THRUSTER PLUME

HALF IS OUTSIDE 30° CONE

60% 50%

40% 30%

20%

10%
SPECIAL HI-PROP USE
BUT VERY GENTLE
APPROACH BRAKING SCHEME

- JETS FIRED: F1F, F2F, R1A, L1A
- C.M. LOCATION 89.68, 0.31, 18 (FT)
X-Y-Z ORBITER STRUCTURAL COORD. SYS.

DYNAMIC PRESSURE CONTOURS
POWERS OF 10
(LB/FT²)

ORBITER BODY Z AXIS (FT)

ORBITER BODY X AXIS (FT)
BACK END OF SHUTTLE - AWKWARD CONFIGURATION

HAS MAJOR IMPLICATIONS TO THIS CASE - BUT NO PREVIOUS INVESTIGATIONS RECOGNIZED.

JET "L5D"

Orbital Maneuvering System/Reaction Control System Pod

T-O Umbilical Shell and Main Canted Frame

Aft Fuselage Access Door Thrust Structure

Umbilical Doors Secondary Structure

ELEVON Aft Fuselage Structure

UP SIDE, AFT JETS ARE PRETTY "PURE" - CLEAR "FIELD OF FIRE". BUT DOWN JETS LOSE 30% OF FORCE DUE TO BOUNCE BACK FROM STRUCTURE IN PLUME FLOW.
TV Cameras on Shuttles

**Interior:**
- Mobile

**Exterior:**
- Four corners of payload bay
- Elbow and Wrist of Robot Arm
- Keel and Docking Module Centerline
- Free-flier -- EVA helmet, subsatellites

**Characteristics**
- Lens f/1.4
- Normal focal length 18mm to 108mm
- Minimum focus 3 ft
- Normal max Field of View 30 x 40 degrees
- Color achieved by special lens with color wheels
- Pan and Tilt +/- 170 degrees
- 28 v. DC

ONE MAJOR APPLICATION — IN PROGRESS AT THIS TIME — MESOSCALE LIGHTNING EXP.
OR "MLE" (PRINCIPAL INVESTIGATOR: "SKEET" VAUGHAN

**Task:** Get side views of thunderstorms to seek unusual lightning phenomena such as vertical bolts, sprites

**Method:** Point camera back "down track" to view earth surface at horizon during night passes.
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**Log of AL Video Down**

**Linked From Shuttle FO Whole Flight**

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**STS-48 Orbit 044 (Downlink)**

**Caption:** Earth views over South America, Atlantic, crew wake up, night pass over USSR, China, Indonesia with lightning (MLE), Earth views of the Indian Ocean. A/G audio.

One inch tape change at 20:09

City lights from Europe enter view. Continue over Russia.

Crew wake up call "Bear Necessities", night pass continues over Russia.

Night pass over Russia. LOS TIME VIDEO.


Night pass over China. Some lightning (MLE) visible.

Night pass over China. Dark Earth limb with lightning visible over China and the Bay of Bengal. Continue over Burma, Malaysia, and Indonesia.

Glare enters view and CAM tilts down to PLB.

Glare in view. Full Earth view of the terminator. CAM repositions and views to EE, out of focus.

Full Earth view of the terminator. CAM repositions to the aft PLB. Zoom in on the cradle. Some Iris bloom.

White FOV. Earth limb view of the Indian Ocean enters FOV. Iris bloom. Tilt down to a full Earth view.

Undefinable video.

Undefinable video. MS/Aft PLB with Iris shoulder in the right FOV.

Undefinable video.

MS/Aft PLB. Tilt up to a clouded Earth view.

Undefinable video. WS/Earth limb view of the Indian Ocean.

Full, clouded Earth view.

Undefinable video. CAM repositions to a clouded Earth limb view. LOS TIME VIDEO.
WHERE IS THE CAMERA'S FIELD-OF-VIEW?

30°

VIDEO IMAGE

40°

ZENITH

STRAIGHT BACK

ORBITAL MOTION

ACTUAL EARTH HORIZON IS ABOUT 30° BELOW LOCAL HORIZONTA

CRYSTAL UP LIGHTNING

STRAIGHT BACK OFF TO RIGHT

RELATIVE TO SHUTTLE BODY

RELATIVE TO EARTH AND ORBITAL MOTION

16
HOW MIGHT WHITE DOTS "APPEAR" IN FIELD-OF-VIEW?

SUNLIGHT BATHES THE SHUTTLE BUT BACK-LOOKING CAMERA DOES NOT DETECT IT - NO AIR!

"Appearing Dots" in space shuttle sunrise views

Shuttle rises into sunrise, trailing its own shadow where nearby particles drift randomly into the sunlight, to "appear" near the Earth's horizon.

TV cameras in payload bay (with auto iris wide open) look backwards "down sun" into shadowed region...

... and in the minutes after sunrise, before sunlit Earth closes the iris, often see small dots.

Sunrise takes 10-15 seconds (angular rate: 40 per minute)

SEVERAL MINUTES AFTER EMERGING FROM SHADOW, SHUTTLE CROSSES "TERMINATOR" - LIGHT-DARK BORDER AND REFLECTED SUNLIGHT FROM EARTH FILLS SHADOW ZONE WITH LIGHT

SCATTERED LIGHT FROM SUN SHUTTLE STRUCTURE MAY CAUSE "FOG" IN EDGE OF FRAME
WHERE IS SHADOWED ZONE NEAR SHUTTLE?

THAT IS, CAN A VIEWED PARTICLE DRIFT OUT OF SHADOW AND SUDDENLY "APPEAR"?

YES

NOSE FORWARD

30° TO SUN

MAP VIEW:

ORBITAL MOTION

NOSE 10° DOWN RELATIVE TO PURE LEFT

AND SUNRISE ~45° TO LEFT OF ORBITAL TRACK

"BETA ANGLE" IS VECTOR FROM ORBITAL PLANE TO THE SUN. IT WAS 46.7°

CONFIRMED BY POSITION OF POLARIS IN 40° WIDE CAMERA FIELD OF VIEW
HYPOTHESIS

What Probably Happened

* Shuttle on autopilot overnight prior to day's activities
  Left wing down, belly to wind, nose pitch down 10 degrees
  Exterior cameras under ground control for lightning observations
  Flight crew engaged in "post-sleep", not looking outside or even watching monitor

* Sunrise began at 20h38m02s (took 16 sec to reach full)
  Indicated by appearance of upper left corner glare (off Ku-band antenna?)
  Further indicated by simo appearance of three drifting dots in lower FOV
  (appearance at this precise moment indicates their proximity to shuttle)

* Over several minutes around SR, shuttle attitude is approaching "deadband" value
  Camera's aft-pointing view of Earth does not change since surface still dark
  Some new particles appear, some original particles drift out of FOV

(more)
### Page from Daily "Execute Package"

**CDT = GMT - 5 HRS**

Page from daily "execute package" shows crew just getting up - refutes theories of secret experiments.

### Notes:

- **AS PLANNED FD3**
- "EVENT" at 20:39:24 CDT shows it was at sunrise.
TELEMETRY DATA: WHY JET FIRED & WHEN

DAP ERRORS, IMU BODY RATES & RATE ERRS

1-ROLL DAP ERROR
2-YAW DAP ERROR

DIGITAL AUTOPILOT ERROR
ALLOWABLE DEADBAND = 10
SLOW DRIFT IN PITCH
ROLL

PITCH
JETS COMMANDED ON
WHEN ERROR REACHED 10 LIMIT

YAW

1-ROLL IMU BODY RATE
2-PITCH IMU BODY RATE

ROTATION RATES

CHANGE IN RATE IS ABOUT 0.01 DEG/SEC
AND IS IN BODY-AXIS PITCH (ALONG HORIZONTAL AXIS OF TV VIEW)
SO IS COMPLETELY UNNOTICEABLE ON VIDEO

1-ROLL RATE ERROR
2-PITCH RATE ERROR

ROLL

PITCH
THIS IS WHY THERE'S NO MOTION OF HORIZON AFTER THE PULSE

YAW

ROCKET BURN

GMT
258:20:36:30:000
258:20:37:30:000
258:20:38:00:000
258:20:39:00:000
258:20:40:00:000
258:20:41:00:000
258:20:42:00:000

Flights: STS-048
### Telemetry Data: All Jet Firings in Period

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**Duration of 1.2 Seconds Looks Like Duration of Particle Course Change (Chart 04)**

**Time of Zig-Zag**

**LSD Jet Left Down Vernier**

**Autopilot Was Set to "Vernier Only"**

**RSD Jet Right Down Vernier**
(continued)

* Another dot appears in center of FOV, near (measurably below) Earth horizon
  Exits from shadow over shuttle's left wing
  Not in atmosphere because straight flight path not refracted
  Reaches full brightness over period of one second

* Autopilot commanded firing of thrusters L5D and R5D
  -- Begins at time of 20h39m23.79s, lasts for 1.2 seconds
  -- Shuttle pitch rate changed by 0.01 degrees/sec (along horizontal in FOV)
    (undetectable from image measurement alone)
  -- Outer plume impinged left wing trailing edge and bounced back up,
    sweeping through space above the wing and gently nudging all particles there
    (down thrusters lose 30% of their force due to structural impingement)
  -- Flash was "ragged" because thruster firings not always visible

* The "great zig-zag dance" occurs
  -- "Main object" turns
    Course change achieved in slightly more than one second
    Subsequent brightness reduction consistent with distancing (Carlotto)
  -- Five other objects in FOV also turn (a few others do not)
    One of them had appeared at sunrise 80 seconds earlier
    This specific object provides conclusive key to explain event
  -- Two fast moving dots cross FOV originating from lower left
    ALL FAST-MOVERS (EVEN STARS) LEAVE STREAKS
    ON CAMERA OPTICS -- EVEN MISLIFTEN FOR METEORS
VIEWING ENTIRE VIDEO SEQUENCE REVEALS THAT PARTICLE RATSCHÈS (CARLOTTA "M" in chart 03) IS THE KEY TO OPENING THE PUZZLE

1. FLARE IS SEEN AT 20:39:24 AND PARTICULAR MAKES COURSE CHANGE (80 SECONDS) IS IDENTICAL TO INTERACTIONS OF SHUTTLE EVENTS ALL EVENTS TO SHUTTLE EVENT.

2. DRIFTS LINEARLY FOR ~80 SECONDS.

3. FROM SUNRISE TO JET FIRING (~80 SEC.) CONNECTS.

OTHER DOTS AND GLARE IN POSITION FROM ~20:38:05 SIMON WITH UPPER LEFT CAMERA FIELD-OF-VIEW.

AT SHUTTLE SUNRISE, IMPLIES ITS 239.
VERY SHARP TURN IS GEOMETRY ARTIFACT OF VIEWING DEPARTING PARTICLE FROM CLOSE TO ITS POINT OF ORIGIN. ACTUAL COURSE CHANGE MAY BE 30-40° OR EVEN LESS.
Additional technical data never sought by previous researchers

* Thruster firing histories
* Crew timeline
* Camera pointing and field-of-view size
* Autopilot record of pointing errors
* Calculation of precise moment of sunrise
* Actual shuttle orientation, relative to sunlight
* Interviews with primary witnesses (crew and mission controllers)

(Without these details, attempts to guess or estimate actual situation were doomed to failure.)

ALL EARLIER RESEARCH WAS SUPERFICIAL AND INADEQUATE AND NAIVE—OFTEN, IT SEEMS, ALMOST DELIBERATELY SO.

RUNS NO RISK OF 'SOLVING' A VERY 'USEFUL' CASE FOR PERSUASION

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Dear Dr. Wieder,

I'm writing in response to your recent request for a copy of the following information relating to the above information is enclosed.

The fee for the enclosed information is waived as the cost is less than $5.

Per NASA regulations (14 CFR Sec. 1206.700 (1)(2)), the original fee for the information is $5.

2. A copy of the original review by NASA scientists.

3. Copies of any videos which cover the original event or any videos prepared especially for UFO investigators or others making inquiries.

4. The exact time of the firing of the vernier thruster in relation to the time that the objects in the video start to change direction.

5. Copies of correspondence between NASA, Ms. Beverly Kruse, George Brown, etc. Included is correspondence file between NASA and any requestors of the video.

I've enclosed a copy of the following information relating to the video taken during Shuttle Mission STS-48:

Anybody willing to obtain, if easy to obtain, 1994, October 27, 1994.

Sincerely,

Stella Luna

P.S. Records were always easy to obtain, if you always look...
Main Errors in Previous Studies (Kasher's "Five Proofs It Can't Be Ice")

"A Scientific Analysis of the Videotape Taken by Space Shuttle Discovery on Shuttle Flight STS-48 Showing Sharply Accelerating Objects", Jack Kasher, PhD, U of Nebraska at Omaha, June 30, 1994. Supported in part by a grant from the Fund for UFO Research.

Proof 1: During the approx. 1 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 2 or 3 pixels off from where a smooth curve would have moved it. This must be deliberate and cannot be natural. IGNORES ERROR BARS WHICH IF ADDED SHOW CONSISTENCY WITH CONTINUOUS GENTLE CURVE DURING AND ONLY DURING DURATION OF THE DOCUMENTED FIRING.

Proof 2: The two fast-moving particles must have been travelling directly away from the RCS thruster. Appendix J proves that only the aft left-firing vernier (LSL) could possibly affect the motion of particles above the shuttle ("This is crucial when we examine the trajectories of the objects more carefully"). Their motion is linear ("If a rocket did the firing, the lines MUST meet"). Since the lines and the line of the main object do not trace back to a single point, they cannot be ice particles accelerated by a thruster. WRONG ASSUMPTION OF WHICH JET FIRED BASED ON ABSENCE OF TELEMETRY RECORDS AND LACK OF KNOWLEDGE OF ACTUAL PERFORMANCE OF DOWN-FIRING VERNIERS, INCLUDING RANDOM WIDE BOUNCEBACK OFF WING.

Proof 3: Any particle in the thruster plume would be accelerated nearly to plume velocity (96%). Appendix B proves this, that the acceleration is independent of the mass or drag coefficient of the particle. The main object clearly wasn't accelerated to this speed by the thruster firing, which lasted 0.4 seconds (as measured by the duration of the pulse). So it couldn't have been a particle. MATH ERROR CAUSING PARTICLE MASS TO CANCEL; FALSE ASSUMPTION THAT PARTICLE MUST BE IN PLUME.

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 about 64 ft away from the thruster. That half second delay is too long for the fast-moving exhaust, so it couldn't have been ice. OVERLOOKS EARLY FLASH, MISTAKENLY BELIEVES FLASH INDICATES ENTIRE THRUSTER FIRING; OWN CHARTS SHOW OBJECT CHANGING COURSE DURING AND ONLY DURING FIRING.

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. FALSE ASSUMPTIONS ABOUT PARTICLE BEING IN FULL PLUME RATHER THAN EDGE.
Main Errors in Previous Studies (Carlotto, "Journal of Scientific Research")

"The lack of any deflection in star motion or change in the position of the horizon line suggests that the flash was not caused by a thruster firing." WHEN CONFRONTED WITH THRUSTER FIRING DATA, RECANTED

"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 one second period". OVERLOOKS ANGULAR SIZE OF SUN WHICH WOULD CAUSE EXACTLY SUCH A GRADUAL RATHER THAN ABRUPT ILLUMINATION.

"When M1 appears in the video, the shuttle is in daylight with the sun to the right. It is thus unlikely that M1 is near the shuttle since there is no mechanism to explain its appearance." Figure 4 (p. 48) shows sun in front of and 10 degrees ABOVE nose of shuttle, with no shadowed regions at all. INCORRECT SPHERICAL TRIGONOMETRY, PLUS OVERLOOKS EVIDENCE THAT SUN IS OFF THE NOSE BUT ABOUT 30 DEGREES BELOW THE NOSE, CREATING ENTIRELY ADEQUATE SHADOWED ZONE ABOVE WING.

The dots can't be ice because "all the objects in the shuttle video appear to be about the same size, yet some scintillate and some do not". Further, "The thruster firing does not seem to alter the brightness characteristics of any of the objects. This implies that the objects are not affected by the gases and must thus be far from the shuttle." DEPENDING ON SHAPE AND MOTION, SOME ICE DOES FLICKER AND SOME DOESN'T. ROUNDED PIECES RARELY FLICKER NO MATTER WHAT SPIN RATE. POSTULATES IMAGINARY CRITERION.

Published attempts to prove that these phenomena have NO possible prosaic explanation fail fundamental principles of scientific argument: the criteria proposed are never tested under double-blind trials to validate their efficacy in discriminating prosaic from other.

MAJOR FAILURE OF FUNDAMENTAL SCIENTIFIC METHOD — FAULTY CLAIM TO ELIMINATE PROSAIC EXPLANATION VIA CRITERIA NEVER TESTED AGAINST REAL CASES — BASED ONLY ON GUESSES.
STS-48 zigzagger joins other notorious bogus "astronaut UFO" stories

* NASA "Chief of Apollo Communications" Maurice Chatelain (pure fiction)
* Mercury-7 "blob" photo (tethered tracking balloon outside window)
* Gordon Cooper's Mercury-9 encounter (fictitious, probably by Frank Edwards)
* Robert White on X-15 ("There are things out there!") - ("...the size of a piece of paper.")
* Jim McDill's "beer can" on Gemini-4 (probably own booster; all photographs released)
* Twin force-field UFOs photographed on Gemini-7 (retouched view of two nose thrusters)
* Gemini-7 "bogie" (debris during booster re- rendezvous; Borman denounces "UFO freaks")
* Gemini-11's fly-past and photography of blobby UFOs (Soviet Proton-3 satellite)
* Gemini-12's "four in a row, not stars" (describing four trash bags recently jettisoned)
* Apollo-11 voice transcript of UFOs on surface (fabrication by tabloid newspaper)
* Apollo-11 photographs of fuzzy spheres (retouched photos of window reflection of ceiling light)
* Apollo-12 photographs of bright structured disk (retouched photos of S4B staged sunlit top)
* Apollo-12 translunar companions (jettisoned "SLA panels", the LM's garage walls)
* Apollo-16 "disk over moon" (probably window reflection of camera's own sunlit lens)

STS-29 "alien spacecraft in view" (Hoax voice on amateur frequency used to relay air-to-ground)
STS-33, 44 Story Musgrave's "space snakes" (jettisoned twisting wire or tile gap filler strip)
STS-58 overtaking UFO during launch (camera is panning down near horizon, light is a/c or star)
STS-6x Hubble Repair Mission objects (ordinary payload bay detritus)
STS-73 "We have an unidentified flying object" (joke in windowless Spacelab about crewmate's anatomy)
STS-80 fleets of UFOs (another post-sunrise panorama of sunlit near-shuttle debris)
STS-82 "What's that flashing" (conversation inside airlock about blinking LED panel display)

...and doubtless many, many more to come.....
Eyewitness Testimony

Monday, February 22, 1999 7:53:54 AM
From: james.r.bates1@jsc.nasa.gov (Jim Bates has worked in Mission control since Gemini days)

Jim, During STS-48 I was in MCC watching the 'snow' or ice particles during the low-light level TV scenes. For many flights during slow times when crew was asleep (or awake) we would watch chunks of ice float away from main engine nozzles and ice fly out of RCS (and vernier?) thrusters. AND we would watch the small 'snow' get blasted by the thruster plumes. The bigger ice pieces from the SSME's would slowly tumble away, turning and glinting sunlight in the process. If someone saw only a piece of such videos, yes they could think they are UFO's. And to them, they are UFO's. But, I'm sorry, these things are not.

I was a Flight Integration Manager for the Shuttle Program Office during those days and was the manager of the Customer Support Room where most of the payloads and other tests were managed or run. For STS-48, I worked one of the shifts in the CSR. I had also worked with Skeet Vaughn to get his lightning survey implemented, and was very familiar with all of the low-light TV 'phomena' we watched for hours upon end during many of the flights.

Yes, you can quote me on this topic. I was very amused and amazed when I caught a portion of the TV show last week that showed a 'physicist' who was studying the ice crystals being blasted by the attitude thrusters. Of course, he only saw a part of the big picture and was trying to come up with a solution with limited knowledge.

(30 DELETED)
L5L THRUSTER
PLUME BOUNCE-BACK
OFF ELEVON, INTO
FIELD-OF-VIEW OF
CAMERA-C