

Visual Observations of Space Shuttle STS-72 Entry

In January 1996 there was a fortunate concatenation of orbital trajectories, shuttle activities, ground lighting conditions, weather, and 'time available' to alert a network of amateur sky watchers that the fireball entry of a space shuttle might be visible. Together with NASA trajectory experts Gil Carman and Dan Adamo, I posted Internet instructions on what to look for and where and when.

"We [in Houston] are expecting a very nice northern pass of the STS-72 entry fireball tonight, about 1:27 AM CST, at an elevation a bit below 20 degrees," was my last message prior to the actual event.

There was one more item to ask for. "People who are nearer the STS-72 entry ground track -- say, with viewing elevations of 60 degrees or more -- may want to participate in simple experiments to characterize the still-mysterious 'electro-phonetic sound' phenomenon associated with bright natural fireball meteors (or 'bolides'). For centuries there have been occasional eyewitness reports of hissing or swishing sounds simultaneous with fireball passage. Although these reports were long dismissed as imaginative, it has now been established that radio noise in the 8-10 KHz band is generated in the bolide plasma trail, and that such radio noise is powerful enough at a witness's location to acoustically couple into certain materials, generating ambient and non-directional sound. The types of material most effective in this radio-to-sound coupling are still in need of better characterization, and they include dry pine branches or other dried leaves, crumpled aluminum foil, dry frizzy human hair or wigs, eyeglass frames of all materials, metal fences and sheet metal buildings, and any other materials that have small-scale structure and some freedom of vibratory motion. Viewers are encouraged to set up experimental samples for observation, and to report ANY sorts of sounds as well as the types of materials in their environs."

In Houston, the weather was bad and we saw nothing. But in the hours that followed, an amazing chain of reports filtered in by email. This turned out to have been one of the best observed shuttle fireballs in history.

MAUI

Gil Carman received this sighting report from Ken Harris on Maui, Hawaii. It passed over there at 380 kft, so apparently there are enough air molecules to start creating a plasma glow then, as he suspected.

Date: Saturday, January 20, 1996 2:36AM
From: Ken Harris <kharris@maui.com>

Whoa! Saw it! Just when and where you predicted. The glow was barely visible, but I could see bright flashes of light, which I assume were RCS burns. It was moving quite a bit faster than I'm used to seeing it*. It streaked right past Orion. Went home and turned on HNN and they covered the landing (we got no NASA Select). Thanks again.

*JEO: An angular motion effect of the much shorter range (lower altitude, 75 miles versus normal 200-300 miles). Actual velocity at this point was only a bit higher than normal for orbital altitude.

TUCSON

From: avarner@azstarnet.com (Alan Varner)
Date: Sat, 20 Jan 1996 14:51:42 LOCAL

Saw the shuttle reentry here in Tucson starting at approximately 12:22AM. There was an orange spot that came out of the west with a very bright trail streaming behind it. The trail was bright white directly behind the shuttle. The trail and view continued until the shuttle past out of sight in the east. The light from the shuttle was bright white in the center and deep red at the edges. A look at the trail with binoculars made it look very much like an illuminated jet trail. No sonic boom was heard

PHOENIX

From: justind6@imap2.asu.edu (Justin Davenport)
Date: Sat, 20 Jan 1996 10:48:20 -0700

Well, what do you know -- I got out of the house just before 12:20 am MST and looked in the southern sky. The horizon was obstructed somewhat by palm trees but I saw the Endeavour low on the horizon, passing between the trees. I saw a bright burnt orange dot, which was large and easily visible, like the planet Jupiter, move from west to east and the dot was about 5 degrees above the horizon. It was spectacular to say the least. I didn't see any "neon tubes" or contrails -- but maybe that was because the shuttle was pretty low on the horizon. . . .

LUBBOCK

From: Cranston Reid <creid@Onramp.NET>
To: Carman, Gilbert L.
Date: Saturday, January 20, 1996 8:51PM

Thanks so much for alerting us to one of the most beautiful, fantastic sights of the night sky! Wonderful view from Lubbock, TX @ 11.0 deg. elevation. I plan to be at the ground track next time. --Cranston Reid (WA5TBB)

SAN ANTONIO

From: dcigary@txdirect.net (Gary Eckhardt)
Date: Sat, 20 Jan 1996 23:07:38 GMT

Since everyone else is submitting their stories...

After getting off work around 12:30am or so (I really HATE Oracle Financials), I came home, broke out a few homebrews, and praised homage to the gods of the weekend. After flipping through a few TV channels for about 50 minutes, I decided it was time to let the dog out for his final patrol of the backyard and hit the hay. While waiting for the dog to make sure that there were no intruders in the yard, I looked over to the NorthEastern horizon, and saw what looked like a laser beam of some type, stretching from horizon to horizon.

Hmmm. A laser beam. Nope, that can't be it, cause there's that nice bright fireball that's making it. Maybe a meteor. Nope, never seen a meteor leave a neon looking trail....and what's that....it looks like smoke?

HHHHHMMMMM....let's see....1...2...3 ok, 3 beers since I got home. Well, I've never seen little green men on that few beers, so just what the heck is this thing? Maybe I'm going to be incinerated by a nuclear blast while I stand here? HHHMM...nope, that can't be it.

I walked inside to see if indeed we were being invaded by spacemen or about to see a nice big fireball, and turned on CNN Headline News. About that time they were discussing the shuttle and that it was about to land in about 10 minutes. WOAH! Was that the Shuttle?!

I came in and logged onto the net, and fired up the newsreader to search sci.space.shuttle. Yep, that's what it was.

Anyway, it was really one of the coolest things I've seen in the sky. And I feel fortunate that I accidentally stumbled across it!

dcigary@txdirect.net (Gary Eckhardt)
Date: 96-01-21 02:39:16 EST

I read your post on sci.space.shuttle, and I suddenly realized that I did hear the swishing sounds as the shuttle passed overhead. Not a very scientific experiment, I know, but there was a definite "strange" sound outside, one that caught my attention when I walked outside and looked up into the sky. (I saw the re-entry by ACCIDENT, I was out on the back porch getting the dog inside....)

What it sounded like was what you would expect to hear from a jet passing at a very high altitude, but without the wavering in volume like you hear from a jet. Just a low, constant, swishing sound.

What I'm hearing is that many people were clouded over, but we had ****CRYSTAL**** clear sky in SA.

AUSTIN

From: ccclaunch@mail.utexas.edu (Charles C. Claunch)
Date: 96-01-21 15:58:15 EST

Wanted to thank you again for the shuttle viewing data (and please pass this along to others whose data you posted). It was fantastic, comparable visually to a Titan 34D launch I saw years ago.

The shuttle and its trail, both orange, were visible through trees near the horizon. Although the sky was relatively bright from ground lights and hazy besides, third magnitude stars were easily visible in Orion and Canis Major. We seemed to be able to see slight ripples in the trail within a few degrees of the shuttle. The trail persisted for several minutes; as it faded, short one-half-degree gaps appeared in it separated by a few degrees, and they grew with time as the trail faded. The shuttle and trail were visible again through trees near the southeastern horizon.

This sighting was a special thrill for my mom. Though a fan of the space program since the beginning (we have a photo she took from our TV with a Rolliflex box camera of Armstrong stepping onto the lunar surface), she had never seen any event of consequence live. She is 69 and unlikely to get to the Cape or to California for a launch, so this re-entry was almost literally the thrill of a lifetime for her.

AUSTIN

From: hagbard@io.com (Jon M Wiley)
Date: 21 Jan 1996 04:38:08 GMT

I can sincerely say it was one of the most incredible things I've ever seen in my life. I saw it under completely clear skies several miles north of Austin at about 1:24am CST. I watched it go from horizon to horizon.

The shuttle was a bright blue-orange speartip blazing a brilliant neon-orange contrail of ionized gas. The contrail faded from orange to yellow to green and spread out. I didn't time it, but it was visible for longer than 5 minutes, more like 7. It looked like it began to curve to the south when it was about 5 degrees above the horizon, the beginning of an S-turn?

If more people could have seen what I saw, NASA's budget would be much larger.

ROUND ROCK (north of Austin)

From: banjo <mustang@bga.com> (Jim)
Date: Sun, 21 Jan 1996 00:13:48 -0600

In Round Rock, Texas, I watched it travel from horizon to horizon. Really impressive. Much faster than the time I saw the shuttle in orbit trailing a satellite with MIR following. (unrelated missions, they just were in the same area at the time) . Wish I had had my binoculars. It left a trail that stayed around awhile. The shuttle was glowing. Dumb question. Why was I able to see a "contrail" at 1:25 AM?

DALLAS

From: jdellinger@amoco.com (Joe A. Dellinger)
Date: 96-01-21 18:45:54 EST

My relatives in the Dallas / Fort Worth area were MOST impressed My father said it was one of the most spectacular things he had ever seen in his life. (He's about to turn 70.) Many thanks for drawing up the predictions and sending them to me!

ARLINGTON

From: tbunce@iadfw.net (Thomas J. Bunce)
Date: Sat, 20 Jan 1996 01:44:33 -0600

Hey, Y'all I just saw the shuttle entry about 10-15 minutes ago and it was SPECTACULAR! I used to simulate the shuttle entry and landing for Lockheed (for JSC) and I never knew how wonderful the entry really was until now. If you ever have the opportunity in the future, it's worth a long drive to get to a place to view it.

I'm in Arlington, TX (Smack dab in between Dallas and Ft Worth) and even with all the light pollution, it was really bright (several times brighter than Sirius), and left a trail all the way across the sky. I expected it to be farther south on the horizon and barely visible, but it was actually fairly high at about 30 degrees.

SOUTH OF DALLAS

Subject: STS-72 re-entry viewing from in the middle of nowhere
From: matulka@convex.com (Jerry Matulka)
Date: 20 Jan 1996 10:54:38 -0600

This morning at o'dark thirty, my family and I were able to witness a most amazing sight. Words are not adequate to describe what it is like to view a shuttle re-entry in person out in the middle of nowhere. Endeavour and the crew of STS-72 put on a most spectacular show.

Our viewing location was from just South of Fairfield Texas on a country road West of I-45 and South of Highway 179. We live in Dallas and could have seen the re-entry from there, however we (mostly me) wanted the best possible view. So it was time for a road trip. I loaded up the entire family into our van and set out from Dallas at about 11:15 PM or so. Our entourage included my wife, two teenage daughters, one teenage son, one granddaughter, and one sister-in-law. The most amazing thing to note about this assembly was that mutiny was never threatened.

Our precise viewing location was selected on the fly. Based on the chart listing viewing opportunities for various US cities, a friend of mine and I deduced that the ground track for the shuttle would take it somewhere near Buffalo, Texas. Buffalo was our goal, but when the time approached 1:05 and we still weren't there I was getting nervous. It was time to take the next exit and find a safe place to park. We stopped the van at about 1:15 AM so we had about 11 minutes to wait.

The weather was brisk and the temperature was probably around 30 degrees. However by now adrenaline was in full swing, so the temperature didn't matter. The sky was perfectly clear. If you haven't been out in the country away from city lights in a while to look at the stars, you really need to try it. While waiting for the shuttle to fly over, we were treated to a couple of shooting stars. It was obvious that these weren't Endeavour because they were flying the wrong direction.

We waited with some apprehension. The first issue was, did the de-orbit burn ever happen or did they wave it off. We left Dallas at 11:15 so that was a good hour and thirty minutes before Endeavour was to commit itself to re-entry. Not having a portable satellite dish we were waiting in the dark (pun intended). The second point of apprehension was how fast was this thing going to be? Were we talking shooting stars that if you blinked you missed it?

My wife was the first of our group to sight the object of our quest. On the South Western horizon was what looked like the fire trail from an extremely large 4th of July rocket. The difference was that this fire trail kept climbing. How majestically and graceful it rose. The speed of the pass was similar viewing an orbital pass. It went almost straight overhead, perhaps 5 or 10 degrees off vertical. The two hour drive hit pay dirt.

The ionization trail stayed illuminated in the sky for some time. It was like a huge neon tube from horizon to horizon by the time the pass was over. I thought the color was orange. Of course my night vision was slightly disrupted by looking in the view finder on the video camera. My wife and my son thought the color was green and white while it was over head. One daughter also thought it was orange. My sister-in-law thought it was cream colored. The other daughter did not comment on the color since she watched from inside the van with her baby.

There was a slight breeze, so not a lot of sound was able to be heard from the passing fireball. At times you could hear something caused by the passing, but I'm not sure how to describe it. A fireball is also a misnomer I think. The shuttle was glowing sort of white hot trailing an orange contrail. I really don't think I could make out the shape of the shuttle it looked just like a glowing amorphous form to me.

As it passed overhead you could see the contrail coming off in a broken pattern similar to smoke. Then it was gone. I didn't time the how long it was visible, but the duration was more than adequate. We waited

and waited for what seemed like an eternity after the shuttle had disappeared beyond the horizon. In reality it was probably only about 3 or 4 minutes. Then the sonic boom came. It wasn't the loudest of booms that I heard, but there was no mistake of what it was.

The party was over, but it was well worth the effort. January 19 was my granddaughter's first birthday. What a candle, Endeavour provided for it (OK so it was a little late). My family is sort of getting used to my crazy expeditions. Back in April of 94 while we were in Florida for the launch of STS-59, I also dragged them out in the middle of the night to watch an Atlas launch. Fortunately for me the Atlas delivered then and the STS-72 crew of Endeavour delivered last night, otherwise I might still be tied up to a tree out in the middle of nowhere.

jerry matulka

BUFFALO (south of Dallas on I45)

From: "david (d.h.) cheek" <danr180@bnr.ca>

Date: Monday, January 22, 1996 8:27AM

Thanks for the info on the shuttle re-entry. I've been trying to see one for about a year and this time was successful. I went to the picnic stop on I-45 between Fairfield and Buffalo, near mile marker 188 to have a better chance to hear the boom. It worked. I heard it about 3:30 after closest approach, which was a little difficult to estimate since the track when so close to overhead. I would estimate the highest elevation at over 50 degrees.

The west part of the plasma trail was visible to the unaided eye even as the shuttle disappeared into the trees in the east. In fact, the west trail was visible after the east end had disappeared. The overhead part of the plasma trail broadened out to about 30 arc minutes wide before disappearing. I think the west end did that also but it was harder to estimate. On the east end, about ten degrees above the horizon, the trail appeared to curve off the right, or south. Was this a maneuver by the shuttle, or just an illusion? The west and overhead portions of the trail did appear straight.

The boom was soft and muffled, nothing like a lower altitude boom from an aircraft. It was still easily distinguishable above the clatter of all the nearby idling diesels. Non of their drivers seemed to be aware of what was happening.

HUNTSVILLE (north of Houston)

Date: 96-01-20 16:00:35 EST

From: LoydO@AOL.COM

I saw the shuttle reentry from 60 miles north of Houston near Huntsville Texas. It was breathtaking. The fireball took about 90 seconds to go from one horizon to the other. I have a video production company in Houston so I used a broadcast quality camera to record the event. The footage is fantastic. All four tv networks here bought a copy of the footage and will run on the news tonight. (1-20-96). Fire trailed the shuttle for at least 90 deg. If you every get a chance to witness a night reentry I urge you to. You will never forget it.

HUNTSVILLE (north of Houston)

From: arodzina@rsoc.rockwell.com (Aaron Rodzinak)

Date: Jan 22 2:11 PM

Me and a friend drove north on I-45 out of Houston last Friday night until we were about 15 miles north of Huntsville, TX. We wanted to get as far from the glow of Houston's lights as we could and we weren't sure how bright the entry of STS-72 was going to be since we'd never witnessed one before. We pulled off on an exit ramp a little after 1:00 am Saturday morning to wait for Endeavour on a clear and moonless night. From the schedule we got off a friend at work, we figured the Shuttle would pass over us at 1:26 am with an elevation angle of about 50 degrees or so to the northern horizon. It flew over right on time and in position of where we suspected. You couldn't miss it!! As it appeared from the western horizon, it looked like a really bright star leaving a white contrail (with a slight orange hue) against the dark sky. The contrail was unbroken from horizon to horizon even after the Shuttle disappeared to the east. Soon, the contrail began to dissipate and as it did, the orange hue turned to red until nothing was left. We waited and listened to witness the sonic boom or the mysterious radio resonance, but it was obvious that we were still too close to the interstate to hear anything other than the passing cars. I bet there were several unsuspecting motorists out there that night that will swear they witnessed a UFO!

CLEVELAND (north of Houston)

From: whale@gp801.jsc.nasa.gov (Hale, N. Wayne, Jr.)

Date: Jan 22, 1:02 PM

I was camped with my Boy Scout Troop at Double Lake Campground in the Sam Houston National Forest near the town of Cleveland Texas (about 85 mile N. of JSC). After ascertaining via cell phone to the MCC that deorbit had occurred, several of us crawled out of our warm sleeping bags (temp in the high 30's at that point) and went to a large field where the thick pine trees did not obscure the view.

However, after having crystal clear conditions at bedtime (about 10:30 CST) it was completely overcast at our location. Therefore we have no report of visual observation, but can make this report of audible indications.

Away from virtually all human presence, the night extremely quite and still. The shuttle sonic boom was clearly and quite loudly heard approximately 01:33 AM CST. (It even awakened some of the sleepers back in camp that had not gotten up, but was not loud enough to rattle windows at the nearby shower house). The sonic boom was clearly a double report (very closely spaced sounds) and was distinctly followed by a swishing or hissing sound for 3 to 5 seconds. This sound was similar to an ball or other object passing rapidly through the air. Since by my estimate it takes 2 to 3 minutes for the sonic boom to reach ground level at nadir (and even longer to our location since we were not directly under the ground track), this should have been well after the shuttle passed its closest approach and therefore likely does not represent some sort of radio signal being transformed to audible sound by local objects.

HOUSTON (mostly clouded out, except....)

From: bjg90783@elroy.uh.edu (B.J. Guillot)

Well, I stayed up late and managed to catch a brief shot of the shuttle re-entry at about 1:28 am Houston time. It was about 80% cloud cover, so I only saw a very short trail, bright white in color, maybe a tint of yellow. The trail seemed to vanish after about 20 seconds. (Last time, I thought I heard that it was visible

for up to 5 minutes, but this was pretty short.). If it had been clear skies, it would have been great. Too bad the weather spoiled most of it.

Date: 21 Jan 1996 21:51 CST

In article, orbit@ix.netcom.com writes... Damn. In Clear Lake it was too cloudy. I stayed outside for a couple extra minutes but didn't see anything, so I went back inside to watch the landing. Maybe next time....

Yes, there was just a little hole in the clouds that I was staring at. I thought to myself--no way will it pass through that whole in the clouds, that looks much higher than 15 degrees.

"I'm not going to see it--I'm not going to see it--WOAH!!!!"

:-) The hole in the sky was small, but I got one whooper of a view for those 20 seconds that the clouds didn't disrupt the view.

B.J. Guillot ... Houston, Texas USA

BAY ST. LOUIS , Louisiana

From: "Terry L. Jones" <jonestl@msrcnavo.navy.mil>

Date: Sunday, January 21, 1996 2:06AM

Gil, I didn't get your message on this until now, but I did get your first entry list showing Gulfport and Biloxi. Thanks for adding Bay St. Louis. I don't have a low lux camcorder, in fact I don't have a camcorder at all, but I could probably get my hands on one for the next time.

Now, about the entry...IT WAS AWESOME!

We probably don't get better opportunities very often, since the strong arctic air mass was just starting to move off of us. The humidity was low, and I live out in the country, so I got a really good show! My wife and I went out about 7:20 GMT to let give our eyes a chance to adjust. I'd never seen an entry before, so I wasn't sure what to expect. I wasn't sure if I'd have a tough time finding it in all the stars. That turned out to be a very naive concern! I had absolutely NO problem seeing Endeavour as she broke the horizon! This incredibly bright orange-yellow streak began to appear, clearly visible through the low trees on the horizon. I estimate that Endeavour was no more than 1 degree above the horizon when I first spotted her. The plasma trail stretched behind her at least 1/3 of the way across the sky. If I had had a camera, I could have taken just one picture with Endeavour in the sky, and the plasma trail reflected in my 3/4 acre pond..all the way across the water..and it would have been a prize winner! The pulsing of the light at the heat shield was clearly visible.

I live about 10 miles north of Bay St. Louis, so Endeavor went almost directly overhead. after she passed by, the trail faded and went out, and Endeavour became merely a bright point of light until she winked out completely.

I have about 30 ducks that I raised on my pond, and they were all sleeping on the far bank, looking east. Being birds, they pay attention to the sky, so when Endeavour got to about 30 degrees elevation, the drakes started up! Then the hens got into it. They were clearly upset by Endeavour! They didn't panic, but it was very clear to my wife and me that they were not happy about the apparition in the sky, they clearly saw it and were watching it intently, and that they were debating if it was a mortal threat. Trust me, I raised these

guys from eggs...incubated them myself and raised them by hand. I know them and what they want and what they are saying! They aren't very complex creatures, so its rather easy to learn to "speak duck". They were riveted on Endeavour's entry, but not in awe, but trying to decide if it were a threat. Birds pay attention to the sky, even if most of these guys are too fat to fly (I feed them well and they grew very big!). But birds are birds...even ducks. Ducks learn at an early age to watch for hawks and other predatory birds. We have hawks a-plenty here, so its something they are attuned to. They used to get upset when the Great Blue Heron came to fish, but he's a regular now, and they simply give way to him without commotion.

Back to Endeavour....Mary and I then waited for the Sonic Boom. I started timing about 2:15 after TCA, just when we were starting to think we wouldn't hear it...the ducks were mostly settled back down, and all was very still..an occasional dog in the distance....**BAHHWHUMP-BA**!!!! I turned to my wife and said "YYYESS!!"

The sonic boom convinced the ducks..they had almost forgotten the plasma trail (anything different fumbuzzles them)...only an occasional soft quack or two from the drakes remained....When they heard the sonic boom, they said "That's it! Its DEFINITELY something that could eat us!!!" And they all "put to sea" in unison...they quickly got into the water and clustered up in the center of the pond! The only time I've ever seen them move faster is then a dog or fox surprises them, and they "crash" "scramble" into the water as fast as possible. That's an uncontrolled panic.

Endeavour elicited a "controlled" panic response!

It was a very uplifting experience. I wanted to cheer them on home. When I brought down the Air to Ground audio after Wheel-stop, two local hams thanked me for the audio, and commented that they also went out to watch the entry.

So, I appreciated the data, and would love to see it in the future, any time it applies here. I posted it on our local packet internet node, and if you dot mind, I'll put it on my Web page: <http://www.datasync.com/~nz8c>

Thank you again! My wife and I deeply appreciated the "heads up" ! My ducks didn't, but being as they are only ducks, its hard for them to understand, so I didn't bother to share the data with them! Besides, it wasn't your data they objected too...it was Endeavour! I told them to take it up with Brian Duffy!

Btw...they executed a steering maneuver before they reached me, so it (the plasma trail) had this really nice smooth bend in it...It was obviously a piloted craft by the shape of the contrail.

From: "Terry L. Jones" <jonestl@msrcnavo.navy.mil>

PENSACOLA

Date: Sat, Jan 20, 1996 8:00 PM EDT

From: tedk1@gulf.net (Ted A. Kirchharr)

Shuttle was visible in a crystal clear sky. Trail was only visible through binoculars. To the naked eye it appeared to a blinking star as it crossed the sky.

Oberg to Kirchharr: Ted, this was a very important observation since nobody was really sure how far down into the atmosphere the fireball and trail persisted. Any further details on brightness, steadiness, etc., will be highly valued!

Kirchharr to Oberg: I'm sorry to say my order of magnitude ratings left me when I left college 'lo those many years ago. It appeared about the same brightness as it would on normal pass an hour or so after sunset. There was a bit of yellow tint to the light. It was not a steady light, different than a blinking star low in the sky. It would nearly disappear for a fraction of a second. Hope this helps.

That's it! What a run!