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UFO UpDates Mailing List

Re: Kenneth Arnold's Sighting [was: Re: Voyager

From: **David Rudiak <DRudiak@aol.com>**
Date: Sun, 13 Jun 1999 03:43:29 EDT
Fwd Date: Sun, 13 Jun 1999 15:01:02 -0400
Subject: Re: Kenneth Arnold's Sighting [was: Re: Voyager

From: James Easton <pulsar@compuserve.com>
Date: Thu, 10 Jun 1999 21:47:16 -0400
Fwd Date: Fri, 11 Jun 1999 15:25:25 -0400
Subject: Re: Kenneth Arnold's Sighting [was: Re: Voyager

Regarding:

>Date: Wed, 9 Jun 1999 01:10:18 -0400
>From: Bruce Maccabee <brumac@compuserve.com>
>Subject: Re: Voyager Newsletter, Mogul Parchment Parachutes
>To: UFO UpDates - Toronto <updates@globalserve.net>

>Bruce,

>In your 'Complete Sighting...' report, you refer to the
>following extract from Arnold's letter to the Air Force:

>"There was a DC-4 to the left and to the rear of me
>approximately fifteen miles distance, and I should judge, at
>14,000 ft. elevation".

>"I knew they [the objects] must be very large to observe their
>shape at that distance, even on as clear a day as it was that
>Tuesday. In fact I compared a zeus fastener or cowling tool I
>had in my pocket - holding it up on them and holding it up on
>the DC- 4 - that I could observe at quite a distance to my left,
>and they seemed smaller than the DC-4; but I should judge their
>span would have been as wide as the furtherest engines on each
>side of the DC-4".

>You then comment:

>"Arnold provided an estimate of size in an indirect way: he
>stated that they appeared to be comparable to the spacing of the
>engines on a DC-4 (4 engine propeller driven, 117 ft wingspan, 94
>ft length, 27 ft height) which he had seen at a distance which he
>estimated as 15 miles. He estimated the engine spacing to be 45 -
>50 ft, although 60 ft would have been a better estimate. By this
>means he was essentially providing an angular size for the
>objects: the equivalent of about 60 ft at 15 miles. He reported
>the size of the objects as 45 - 50 ft by comparison with the
>airplane as if the plane had been at the same distance as the
>objects. However, the plane was not at the same distance, so a
>correction for the distance difference is necessary.

>It is possible to make an estimate of the size of the objects
>assuming his estimate of the distance to the DC-4, 15 miles, was
>(approximately) correct. (Here comes some math and geometry, so

>if you are squeamish about such subjects, skip over the next four
>sentences.) Using the outer engine spacing as 60 ft, the angular
>size at his estimated distance is 60/(15 x 5280) = 0.00076
>radians or about 2.6 minutes of arc (1 degree = 60 minutes =
>0.0174 radians). Projecting this angle to 20 miles, the rough
>distance of the objects, would yield a size of about (20 x 5280 x
>0.00075 =) 80 ft. Had he overestimated the distance to the DC-4
>(if it had been less than 15 miles away) the calculated angular
>size, and hence the calculated object size would increase. If he
>underestimated the distance to the DC-4, then the calculated size
>would decrease. My own suspicion is that he overestimated the
>distance and that therefore the objects were larger than 80 ft in
>length. Unfortunately no investigator pursued this size estimate
>at the time and with Arnold's death many years ago it is no
>longer possible to improve the size estimate".

There's another way to estimate the size based on his
observations when the objects were passing in front of the Mt.
Rainier snowfields. He said that when seen edge on, they almost
disappeared and seemed to be a long dark line about 20 times
longer than thick.

Retinal cones are about 0.4 minarc in size at the center of our
vision, where our acuity is best. Image blur because of
diffraction through our pupils also limits the retinal image
width of any arbitrarily thin line imaged by our eyes to about
0.4 minarc.   (Likely this is no coincidence, but an example of
evolution converging to an optimal value.)

What this means is that we can detect isolated high contrast
dark lines against bright backgrounds (like Arnold's objects in
profile) considerably less than .4 minarc (down to 2 _seconds_
of arc, believe it or not, under controlled laboratory
conditions), but the image of the line will always be perceived
to be at least 0.4 minarc thick.

The closer the very thin line is to 0.4 minarc, the darker it
will appear, which again seems to be the case with Arnold's
sighting. 0.4 minarc at Arnold's estimated 23 miles (based on
the subpeak of Rainier Arnold said they disappeared behind), is
about 14 feet thick, give or take. If we accept Arnold's 20 to
1 length to thickness estimate on face value, this would place
the length at around 280 feet (again give or take). This would
be about the size of a 747.

If, on the other hand, Arnold was off on his length-thickness
ratio by a factor of 2, which is quite possible (and close to
the way he drew it in his letter to AF intelligence), then the
length would be half that, or about 140 feet. This is around
737 size.

I will compare this estimate with that immediately below, based
on Arnold's comparison with a distant DC-4.

>In your paper, 'Still in Default' - 'Originally Published in the
>Proceedings of the 1986 MUFON International Symposium. Updates
>to 1998 in square parentheses', you wrote:

>[Note: a very complete analysis of Arnold's sighting has been
>published in the Proceedings of the International Conference of
>the Mutual UFO Network, 1997. In that much longer paper I point
>out that Arnold compared the apparent size of the UFO to the
>spacing between engines on DC-4 aircraft - 117ft wingspan, 94 ft
>long, 23 ft fuselage height - which he thought was about 15 miles
>away.

>The point is that since Arnold could see the engines on the
>aircraft at 15 miles - or even if it was only at 10 miles - then
>he had better than average visual acuity.

This is a tricky point. I don't know the exact dimensions for
wing thickness and engine size, and Arnold was also looking from
underneath by maybe 4 or 5 degrees and getting a projection.
Let's say the wings were 2.5 feet thick and the engines 5 feet
from Arnold's perspective. That would be close. The cabin
would be about 10 feet across. What would Arnold see from 15
miles?

The engine cross-section would subtend about 0.2 minarc, the
wings about 0.1 minarc, and the cabin about 0.4 minarc. Notice

the same 0.4 minarc threshold mentioned above. We can detect
isolated elements (dots, lines) this thickness or thinner, but
they will all appear to be equally thick. However, they will
not appear to be equally dark.

So if Arnold could detect this at 15 miles, what he would
probably see would be a long thin line of uneven darkness.
There would be a dark spot where the cabin was (and maybe a
faint vertical line for the tail), not-so-dark spots for the
engines, and a faint, almost invisible line for the wing proper.
This is a difficult detection task, but certainly possible.

Another visual acuity task is our ability to detect separations
between nearby objects instead of objects in isolation. This is
the standard eyechart acuity test in the doctor's office with
which most people are familiar. 20/20 English acuity (6/6
metric) means the eyechart letters are designed to be 5 minarc
high and made of lines and gaps 1/5th of this, or 1 minarc.
Therefore 20/20 acuity means the person can just resolve lines
separated by 1 minarc.

Probably close to half of the healthy adult population has
corrected visual acuity of 20/15 or slightly better. Mine,
e.g., has been tested down to 20/12 under controlled laboratory
conditions. Better acuities than this are known, but rare.
20/8, or .4 minarc acuity seems to be the absolute limit, and
again is related to retinal cone and diffraction image size.

This introduction to letter-type acuity tasks relates to the
spacing between such things as the engines and the cabin on the
DC-4. Are they resolvable at 15 miles? The spacing between the
cabin and the inner engines would be about 20 feet, and at 15
miles this corresponds to about .85 minarc, or 20/17 acuity,
right smack in the middle of the expected best acuity for a
normal population. So the answer is yes. At 15 miles Arnold
could make out these things if he had perfectly normal acuity
and no signficant uncorrected eye blur. Judging by what he
reported, it seems that Arnold's eyes had no need for any
optical correction.

Arnold's detection task would obviously have been even easier if
the plane were closer, say 10 miles instead of 15 miles. The
engines would now look like fairly dark spots, and easily
separable from the cabin. It is certainly possible he
overestimated the planes distance by this amount since he was
eyeballing the distance in this case with no landmarks for
comparison.

>Since the engines were about 60 ft apart and since the UFOs were
>farther away than the airplane the estimated size of the UFOs
>would be 80 - 120 feet.)]
[End]

A 10 mile distance would also gives us size estimates for the
unknown objects close to those derived from the other visual
observations of Arnold outlined above.

60 feet at 10 miles scales to 138 feet at 23 miles. Compare
that to the estimated 140 feet based on the length/thickness
ratio.

Let's not put too fine a point on the exact numbers given the
obvious uncertainties and assumptions. But the objects, if they
were at 23 miles, were comparable in size to conventional
jetliners of today like the 737.

These sizes are not "huge" (as Easton put it in another post).
Dr. Alan Hynek, who apparently knew little of measures of human
acuity, claimed that Arnold could not have seen something
thinner than 3.0 minarc, instead of the actual value 0.4 minarc.
(Hynek confused acuity measures and also didn't understand that
the 3 minarc value he used referred to the overall size of a
letter acuity target, not the lines and gaps that made it up.)
This threw off his estimates of size by a factor of 7.5. As a
result, he came up with the absurd numbers that the objects
would have had to be over 100 feet thick and 2000 feet long.
This would indeed be "huge" for an aircraft, but it was grossly
in error.

Hynek used this nonsensical calculation to dismiss Arnold's
sighting, even after he left the Air Force as a consultant.

Instead Hynek proposed that Arnold probably saw a formation of
jets 6 miles distance. However, if you scale to 6 miles and use
Hynek's erroneous figures, the "jets" would have had to be 25
thick thick and 500 feet in length. Hynek never seemed to see
the absurdity of his own arguments.

Interestingly if you read Ruppelt, he notes that Blue Book,
using similar acuity argumentation to mine and assuming Arnold
had the distance about right, placed the size in the 210 to 280
foot range. (Some other AF consultant was apparently much
better informed than Hynek on such matters.) I think it was
about half that figure if Arnold's two separate observations
were to be internally inconsistent.

>When considering all the probabilities, should your above point
>be taken into account?

>Is it being accepted that Arnold claims to have seen the DC-4s
>engines at 15 miles, i.e., sufficiently that he could use this
>observation in a rough calculation?

If Arnold had normal visual acuity and no significant optical
blur, then he could have just seen the positions of the engines
at 15 miles.

>If the DC-4 was 15 miles distant as Arnold claimed, how do we
>quantify "better than average visual acuity" then; would it be
>above average, exceptional or incredible?

See above arguments. 20/20 is considered "average," 20/15
somewhat above average (and very common), and something like
20/12 or better would be considered exceptional to incredible
(like 20/8). Based on sighting details like his ability to
detect the objects as a thin line and his ability to resolve
details on the DC-4, Arnold's acuity was at least in the average
to above average range, maybe better, even without a corrective
prescription.

>In his letter to the Air Force, Arnold also wrote:

>"I observed the chain of these objects passing another snow-
>covered ridge in between Mt. Rainier and Mt. Adams, and as the
>first one was passing the south crest of this ridge the last
>object was entering the northern crest of the ridge. As I was
>flying in the direction of this particular ridge, I measured it
>and found it to be approximately five miles so I could safely
>assume that the chain of these saucer like objects were at least
>five miles long".

>You have referenced this 'five mile' chain in the 'Complete
>Sighting...' paper, i.e., "Since the length of the 'chain' of
>objects was about 5 miles (paragraph H [as] above), the leading
>object was about 5 miles south of Mt. Adams when the last object
>passed Mt. Adams".

>What Arnold doesn't explain here is that he DID NOT measure this
>ridge at the time.

What possible difference does it make?

>At least according to the details in his book, when he writes,
>"Between Mount Rainier and Mount Adams there is a very high
>plateau with quite definite north and south edges. Part of this
>chain-like formation traveled above this plateau towards Mount
>Adams, while part of the formation actually dipped below the
>near edge. As the first unit of these craft cleared the
>southernmost edge of this background, the last of the formation
>was just entering the northern ridge.

>I later flew over this plateau in my plane and came to a close
>approximation that this whole formation of craft, whatever they
>were, formed a chain in the neighbourhood of five miles long".

>So, the 'five miles' estimate wasn't in fact made until later,
>quite different from the impression given in his Air force
>letter.

>Would you agree that seems to be correct?

Again, what difference does it make? At some point he flew over the ridge
and measured it.

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Like his clocking of flight time between Mt. Rainier and Mt.
Adams, this was an objective measurement and gives us some idea
of how spread out the objects were. (It's also another
indication of how methodical Arnold seemed to be.) If the ridge
was 25 miles from his position, then the objects subtended an
angle of about 5/25 = .2 radian or 11 degrees.  You can scale
for various distances to get the approximate distance between
objects.

Say they were those giant American White Pelicans (AWPs) only 1
mile away.  The linear formation would have been spread over a
distance 1/25th of 5 miles or about 1000 feet, each AWP
separated by about 125 from the one in front.  Unfortunately
flocking birds flying in formation have to be within a few feet
of one another to get the energy saving benefits of flocking.
So even at a distance of only 1 mile, the distance between
objects would be far too great to have been birds in formation.

If you try to salvage the situation by bringing the "pelicans"
ten times closer to only 500 feet and 12 foot separation, only
somebody flying with a white cane could fail to see them for
what they were.  If Arnold could make out the engines of a DC-3
at  10-15 miles, as indeed he could with normal visual acuity,
he could easily have made out the large pelicans at 1 mile, much
less 500 feet.

We still await Easton's explanations to all the fatal objections
that have been raised to his bird theory.  To repeat:

1.  How to AWPs (or any bird) flash brightly in plain daylight
against a snow field background?

2.  How can AWPs outfly Arnold's plane on a parallel course?

3.  How could the linear formation of objects subtend the angle
reported by Arnold and still be flocking AWPs.


David Rudiak
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