



An early photo of Kenneth Arnold with his 1947 CallAir mountain plane (NC33355)

The Singular Adventure of Mr Kenneth Arnold

Martin Shough¹
© June 2010 (revised July 2010)

The author would like to acknowledge in particular Mary Castner, Barry Greenwood, Patrick Gross, Jean-Pierre Pharabod, Don Ledger, Tom Tulien, Brad Sparks, Joel Carpenter, Bruce Maccabee & Andy Coupland for valuable discussions, encouragement and information during the course of this inquiry.

¹ UK Research Associate, National Aviation Reporting Centre on Anomalous Phenomena ([NARCAP](#)).
parcellular@btinternet.com

The Singular Adventure of Mr Kenneth Arnold

Martin Shough

1) Introduction

In one sense it would be true to say that this seminal sighting of nine "peculiar looking aircraft" over the Cascade Mountains of Washington on June 24 1947 (see Appendix 1) needs little introduction. As a result of it pilot and businessman Kenneth Arnold acquired a fame and notoriety far beyond anything he could ever have envisaged when he took off from Chehalis, Washington, and set a course for Yakima in his little CallAir plane that sunny afternoon. News of what the press dubbed "flying saucers" instantly captured the imagination of the world, and reports of things seen in the sky have ever since continued to fuel one of the 20th century's - and now the 21st's - most widespread, most persistent and most influential popular mythologies.

Yet that mythology has effloresced into many extraordinary forms, most of which the Kenneth Arnold of 1947 would hardly have recognised as having anything to do with his own puzzling but straightforward observation. And it is necessary to record that despite more than 60 years of sometimes scholarly debate about this hydra-headed mythological monster, its origins remain not well-understood, its meanings controversial, its ultimate cultural value uncertain.

Simply by being the first,² Arnold's experience enjoys a unique position of pre-eminence in both the history and the semiotics of saucerdom, ensuring that his narrative has been retold and repackaged innumerable times. Tracing the progress of that one narrative in its transactions with the co-evolving meta-narrative of our times becomes a social history in itself, one which few historians have tried conscientiously to unravel. Instead, Arnold's narrative or some version of it has all too often been exploited, to the detriment of history and objectivity, as a mere didactic fable enlisted to serve conflicting ideological agendas.

A survey of the literature reveals a good deal of inaccuracy and even misrepresentation. Such is to be expected in parts of the enthusiast literature. But all too often it comes from otherwise well-informed and sensible critics from whom one expects better. Perhaps in some cases this reflects the significance of the Arnold sighting as a laboratory for testing our theories about the psychosocial roots of the UFO myth - the issues are exposed with unique clarity, and the stakes are that much higher, the temptation to find confirmation of our prejudices that much greater.

Of course most of science and society today remains aloof from the question. Keeping a cautious distance is understandable - a too-impressionable intimacy with the facts has undoubtedly left many enthusiasts in thrall to the myth itself. In-depth studies with no agenda do exist, but they are few and much published material is undeniably discouraging. The unhelpful result is that our opinion-formers by and large keep so prudent a distance from the myth that they cannot clearly make out the nuclear facts at all, leaving the rest of us relying with scant confidence on popular rumour.

So there is still a need for a rigorous re-examination of what Arnold said he saw, as well as a mature understanding of the ways in which his story reflected, and was reflected by, the contemporary culture. Obviously no individual analyst can hope to have the 'final word' in such a complex and difficult area. It is an ongoing project, in which the present study is offered as a contribution. Inevitably many of the issues addressed here have been broached by others; but not always fairly, and, when fairly, not always thoroughly or in an integrated way. I hope the reader will also find some fresh perspectives here on what remains a fascinating historical mystery.

2 Not the first sighting of something puzzling in the sky, of course, but the first widely-publicised report of unidentified flying machines in the modern post-war era, and the unarguable trigger for the social phenomenon that ensued.

2) A note on units

Belgian researcher Roger Paquay has argued³ that an aviator would automatically use *nautical miles*, so that all calculations of the sighting geometry assuming distances in statute miles would be in error by a factor 1.15. For example, by adopting Arnold's upper bracket of "25 miles" distance to the objects we could then place them nearly 29 statute miles (45km) away, with consequences for the discernibility of the shapes of objects that might be close to the limit of resolution of the human eye (see Section 8). It doesn't appear that this issue has been raised in earlier literature.

The world of modern aviation does widely use knots, of course, and the modern aeronautical charts used for navigation in commercial and military sectors are scaled in nautical miles. But the AAF investigation established early on that Arnold never used specialised aeronautical charts (see Fig.1). Indeed it would be surprising to find a private pilot in the Pacific Northwest thinking in knots and nautical miles in 1947 when US CAA standards were still specified in statute miles per hour and would remain so for another 22 years.⁴ Even today performance specifications of aircraft are almost universally given in statute mph, followed by km/hr and possibly knots.⁵ Moreover if Arnold had meant knots because he thought in terms of knots, then one feels that he would have *said* "knots", but he always used mph. And we have several internal tests that can be done on speeds and distances contained in Arnold's own accounts to prove rather nicely that he was thinking in ordinary statute mph. For example:

a) Arnold contrasts the calculated speed of his objects with the fastest jet airspeed thought possible in June 1947, i.e. approaching Mach 1.⁶ That speed he gives as "in the vicinity of 700mph".⁷ Interpreted as statute mph this is correct. But 700kt or 805 mph would have been well over the highest possible value of Mach 1, which rises to only ~760mph exactly at sea level

b) Arnold describes⁸ how the speed estimate was made when he landed at Pendleton by transferring the objects' clock-timed 102sec transit between Mt Rainier and Mt Adams onto a map. Taking the distance between points near the *summits*, said Arnold, they kept coming up with about 1700mph. If he had meant 1700 knots (nearly 2000mph) this would imply that the distance between summits was about 48 nmi (55.2 statute miles). In fact it is only ~41nmi. But 102 seconds over 48 *statute* miles does equal about 1700mph, proving that they were measuring their map in statute miles.⁹

3 Roger Paquay, email to Martin Shough 24.11.2009

4 "Prior to 1969, airworthiness standards for civil aircraft in the USA [Federal Aviation Regulations](#) specified that distances were to be in statute miles, and speeds in miles per hour. In 1969 these standards were progressively amended to specify that distances were to be in nautical miles, and speeds in knots."

[http://en.wikipedia.org/wiki/Knot_\(unit\)#Aeronautical_terms](http://en.wikipedia.org/wiki/Knot_(unit)#Aeronautical_terms)

5 A 2007 discussion on units on the WikipediaTalk aviation projects page concluded with the following (abbreviated) explanation of why statute miles and mph were settled on for WP:AIR over nm and knots: '... practically all aviation reference books intended for a general audience use statute miles; and very many (if not most) books intended for a specialised, enthusiast audience do too. Every one of the English-language books that I use on a regular basis for my contributions gives figures in statute, not nautical, miles. The nautical mile is not only irrelevant to most readers of our articles, but in fact to the specifications of many (I would guess even most) of the aircraft we have articles on.... In the US, the Navy always used and continue to use the nm, but the Army/Air Force only introduced it after World War II (1946 or 48?), and civil aviation only started to use it in 1952. Even in 2007, many suppliers and manufacturers in the burgeoning homebuilt market seem to specify in statute miles.... We cover a lot of pre-1948 US Army/Air Force aircraft and pre-1952 civil ones.' http://en.wikipedia.org/wiki/Wikipedia_talk:WikiProject_Aircraft/Units

6 Yeager's record-breaking experimental X-1 rocket famously did not break this so-called barrier until 4 months later.

7 Arnold, K. and Ray Palmer, *The Coming of the Saucers*, Amherst 1952 pp.13

8 Arnold, K. and Ray Palmer, *The Coming of the Saucers*, Amherst 1952 pp.13-14

9 Actually the true distance appears to be a little under 47 statute miles but the thrust of the argument is unaltered.

after having checked an aeronautical map of the area over which [REDACTED] claims that he saw the objects it was determined that all statements made by [REDACTED] in regard to the distances involved, speed of the objects, course or the objects and size of the objects, could very possibly be facts. The distances mentioned by [REDACTED] in his report are within a short distance of the actual distances on aeronautical charts of this area, although [REDACTED] Arnold has never consulted aeronautical charts of the type the Army uses.

Fig.1 Detail from the report on an interview with Kenneth Arnold, July 12 1947, by Army Air Force Counter Intelligence Corp agent Frank Brown, July 16 1947 (Project Sign files)

c) Arnold, seeking to minimise this unbelievable result, said he then conservatively moved the points of measurement down from the summits to the bases of the mountain cones, "below the snowline", and got 39.8 miles.¹⁰ 39.8 nautical miles or ~46 statute miles is about 8 statute miles too long to fit between the bases of the mountains below the snowline (~6-7000ft in summer; see below). It's actually very nearly the distance between the summits (or other equivalent points). But 39.8 statute miles fits Arnold's description well.

d) A somewhat weaker argument is that Arnold himself gave the cruise speed of his own plane as "about 100mph"¹¹ or "105mph".¹² (One early newspaper gave the speed of his plane as "about 110 miles an hour"¹³ but this could have been Arnold's estimate of groundspeed, adding a vector component of a 19kt NW wind; see Section.3 & Appendix 2). The specifications of the CallAir Model-A give the cruise (air)speed as about 100 statute mph. Had Arnold been thinking in nautical miles he would have said, firstly "87", not "100", and of course he would also have said "knots" instead of "mph".

10 Arnold's meaning is that he selected a point low on the south side of Rainier and a mirroring point low on the north side of Adams, an interval "so far on the conservative side that I knew it was incorrect" (*ibid.*, p.14). Clearly the interval which he had actually used for clocking the speed - between two equivalent points on the south sides of *both* similar cones (see Fig.4) - would be one mountain-width longer, about the same as the interval measured between summits.

11 Arnold, K., "How It All Began" in Fuller, Curtis G., Proceedings of the First International UFO Congress [1977], Warner, 1980, pp. 17-29

12 "I'll never forget Capt Smith chuckling at my airspeed registering only 105mph". Arnold, K. and Ray Palmer, *The Coming of the Saucers*, Amherst 1952 p.41

13 One newspaper gave Arnold's speed as "about 110 miles an hour" (Pendleton, Oregon, *East Oregonian*, June 26 1947)

3) Reconstruction of Arnold's flight path in relation to Mt Rainier

Forty-eight hours after the sighting Arnold guessed that he had begun his turn and climb towards the sighting point "approximately 25 to 28 miles from Mount Rainier"¹⁴ and that his distance from the objects was "between 20 to 25 [statute] miles" (32km - 40km).¹⁵ Five years later in 1952 Arnold had narrowed these brackets to a figure of 23 miles on the basis that "I knew where I was and they revealed their true position",¹⁶ but this confidence is somewhat belied by 10%-20% error-margins in his contemporaneous accounts, indicating that at the time he was perhaps not quite so certain where he was.

Therefore an attempt is in order to reconstruct Arnold's flight path from topographical reference points, known times and distances and aircraft performance specifications. Several factors in this exercise lead to the conclusion that the closest approach would certainly have been nearer the lower than the upper bracket, and probably was somewhat less than 20 miles (<32km).

Below is the relevant part of Arnold's earliest detailed written narrative, prepared shortly after July 04 1947, a copy of which was sent to the Commanding General, Army Air Force, Wright Field, Ohio, 14 days after the sighting on or about July 08:

I flew [from Chehalis, Washington] directly toward Mt Rainier after reaching an altitude of about 9,500 feet which is the approximate elevation of the high plateau from which Mt Rainier rises. I had made one sweep of this high plateau to the westward [A on Fig.3], searching all of the various ridges for this marine ship [a missing US Marine transport plane] and flew to the west down and near the ridge side of the canyon where Ashford, Washington, is located [B & C on Fig.3].

Unable to see anything that looked like the lost ship, I made a 360 [sic] degree turn to the right and above the little city of Mineral [D on Fig.3] starting again towards Mt Rainier. I climbed back up to an altitude of approximately 9,200 feet.¹⁷ . . . I trimmed out my airplane in the direction of Yakima, Washington, which was almost directly east of my position, and simply sat in my plane observing the sky and the terrain. . . .

The sky and air was as clear as crystal. I hadn't flown more than two or three minutes on my course when a bright flash reflected on my airplane [E on Fig.3].¹⁸

14 Interview with Kenneth Arnold by journalist Ted Smith, broadcast on KWRC radio, Pendleton, on June 26, 1947. Some background on Ted Smith and KWRC Pendleton can be found at the Western States Museum of Broadcasting: <http://www.wsmb.org/Files/WSMB%20Vol%203%20Issue%201.pdf>

15 Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/UFOS files). Note this signed and annotated original is not the recopied version preserved in the Project SIGN Incident #17 case file.

16 Arnold, K. and Ray Palmer, *The Coming of the Saucers*, Amherst 1952 p.12

17 The author is indebted to Canadian pilot and author Don Ledger (emails 12.03.2010 & 13.03.2010) for pointing out that Arnold's altimeter reading may not have been accurate because local temperature and pressure would probably differ from the last pressure setting at Chehalis an hour earlier. Don has known errors up to 800ft over very small distances in this area. On the other hand, sea-level pressure variation on this day was only 4.3mbar between locations well over 200 miles apart on the coast and East of the Cascades and slightly elevated above a standard atmosphere, suggesting a broad region of high pressure consistent with reports of clear weather and exceptionally smooth flying (see Appendix 2). An 800ft altitude error would correspond to about six times this surface pressure variation (0.76" of mercury or 26mbar). This suggests that orographic uplift or 'mountain wave' conditions would be the most likely cause of any extreme and/or rapid fluctuations of pressure between Chehalis and Mineral, which are only some 30 miles apart. These would not be caused by the nearby Cascade Mountains - because the recorded wind (Seattle) was 300°, blowing from the sea and across the low plains WNW of Mineral - but perhaps by the Olympic Mountain barrier rising more than 100 miles NW of the area. Perhaps it is safe only to say that the altimeter is likely to have been accurate to within ±5%. But this margin would not significantly alter any conclusions here.

18 Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/UFOS files)

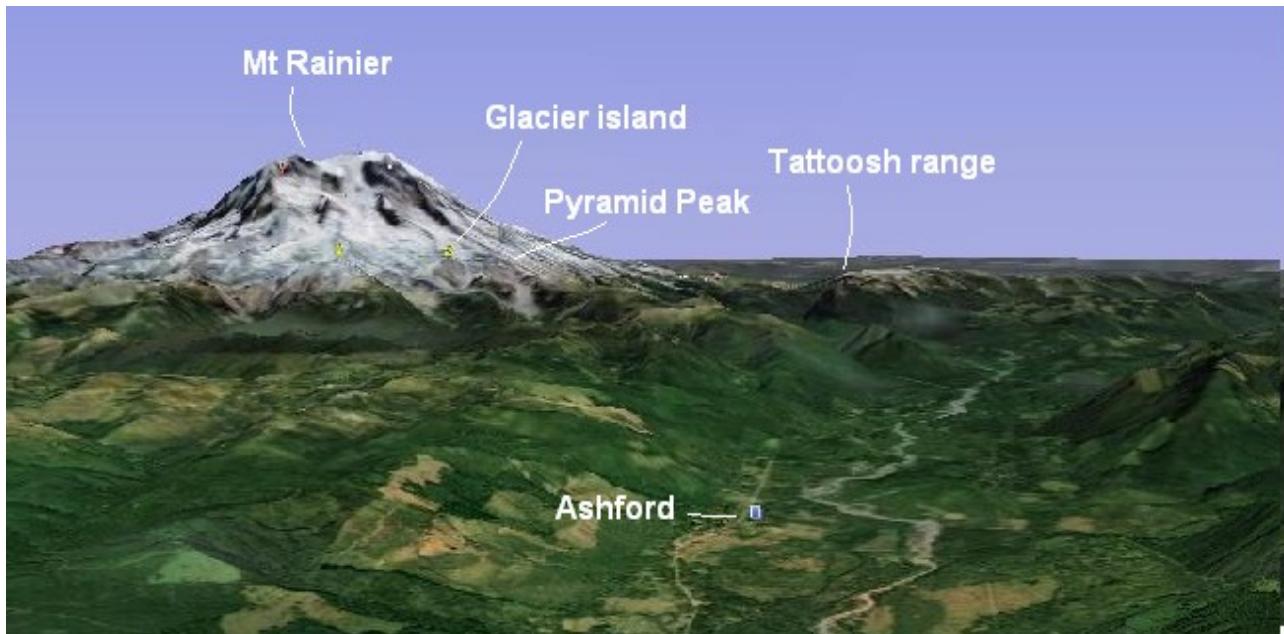


Fig.2 Looking East from 9,200ft near Mineral, Washington, with the summit of Mt Rainier ~20 miles (32km) distant (GoogleEarth image).

There is a back-stop on the possible distance because when Arnold first saw the flashes of the objects approaching from north of Mt Rainier he was flying back east *from Mineral*, which is itself only about about 22 - 23 miles (35 - 37km) WSW of the peak of Mt Rainier. When he saw the first flash he was already 2 - 3 mins of cruise (3 - 5 miles at 100mph; 5 to 8 km) into this leg of his flight to Yakima, with his plane and the objects on converging paths, so he would have been closer still when, after another minute or so, he saw them pass the southern edge of the snowfields of Mt Rainier and cross his course.

In his 1952 book Arnold recollected that he had made his first sighting "while making a turn of 180 degrees over Mineral".¹⁹ In 1977 he repeated this, saying "As I was making this turn . . . a tremendous flash appeared in the sky", but added the confusing rider that it was "as I was making this turn and, of course flying directly toward Mt. Rainier, at about 9200 ft elevation"²⁰ which is only consistent if what he really means is that the first sighting occurred not during but *after* the climbing turn. And this is in fact what he had said explicitly in his original and more detailed July 1947 Air Force letter: He came west at search height down the canyon past Ashford, made a right turn "above the little city of Mineral, starting again towards Mt Rainier" and climbed back to 9200ft, at which altitude he *then* "trimmed the plane towards Yakima" (to pass south of Mt Rainier) and sat back to admire the view *for another "two or three minutes"* before he saw the first flashes off to his left, north of Mt Rainier.

In order to see what this implies we need to investigate the specifications of Arnold's aircraft.

Arnold's CallAir was a specialised, light-weight, mountain plane optimised for performance above about 6,000ft, with a single 125hp Lycoming or Continental engine and big, high-lift wings designed for short take-offs in confined mountain valleys. It was either a late model A-2 or an A-3 and was purchased new from the company in Afton, Wyoming, in January, 1947, registration number NC33355.. It was what was known as a "2-3 place", with a wide bench seat commodious

¹⁹ Arnold, K. and Ray Palmer, *The Coming of the Saucers*, Amherst 1952 p.10.

²⁰ Arnold, K., "How It All Began" in Fuller, Curtis G., *Proceedings of the First International UFO Congress* [1977], Warner, 1980, pp. 17-29. See: <http://www.ufologie.net/htm/arnoldrepuic.htm>

for a pilot and passenger (controls and main instrumentation being, as usual, in front of the left seat) but able to accommodate three if necessary. The CallAir was highly regarded by pilots as agile and dependable, unusually smooth to fly, free of the common light-single vice of pulling left due to the prop wash over the tail assembly and so requiring little handling in cruise.²¹

CALL-AIR A-2	
One air-cooled Lycoming 125 h.p. engine Type Certificate No. 758	
Wing span.....	35 ft. 10 in.
Length	23 ft. 5 in.
Height	7 ft.
Empty weight.....	945 lbs.
Gross weight.....	1,550 lbs.
Wing area	181.6 sq. ft.
Wing loading (per sq. ft.)	8.53 lbs.
Power loading (per h.p.).....	12.4 lbs.
Top speed.....	120 m.p.h.
Cruising speed (75% h.p.).....	109 m.p.h.
Stalling speed.....	45 m.p.h.
Maximum range (60% power) ..	456 miles
Rate of climb (sea level) ..	Over 1,000 f.p.m.
Service ceiling	Over 17,500 ft.
Absolute ceiling	Over 20,000 ft.
Fuel capacity	30 gals.
Baggage.....	Over 100 lbs.
Design structural load factor	4.5 G.
Source: Call Aircraft Company, Afton, Wyo.	

Table 1. From Arentz, B., *The CallAir*, FLYING Magazine, Jan 1950, p.32

The exact performance figures are uncertain. As usual published specifications are optimised and actual performance will vary with propellor size, propellor pitch, altitude, fuel and baggage load etc. Initial hopes that the actual aircraft had been located proved unfounded²² so precision is not possible, but it is possible to be confident of approximate figures. Assuming the 125hp engine (in a late model A-2 or an A-3 of this date), the maximum rate of climb of Arnold's CallAir was about 1000 ft/min with a climb ratio approaching 5:1; the nominal cruise speed in level flight at 75% power was a little over 100mph; and top speed was 120mph at maximum power (Table 1).²³ Some early CallAirs with the smaller 100hp Lycoming engine are credited with having a *higher* top speed (150mph) and higher stall, but a much lower climb rate of only 300ft/min²⁴ perhaps indicating also

21 Arentz, B., *The CallAir*, FLYING Magazine, Jan 1950, p.32

22 What is claimed to be Arnold's original A-2 is today owned by the Skagit Aero Education Museum at Concrete, Washington. It was used for a re-enactment of the sighting by Discovery Channel in 2002. See:

<http://skagitaero.com/aircraft/call-air-a-2/> However SAEM has not been responsive to inquiries, possibly because the N-number of Arnold's CallAir (N33355) is in fact FAA registered today as belonging to a CallAir A-3 certified flightworthy in 1960, see http://registry.faa.gov/aircraftinquiry/NNum_Results.aspx?NNumbertxt=33355 which appears to corroborate information from pilot and author Don Ledger (private communication 17.03.2010) to the effect that Arnold sold his original CallAir which was then crashed in Mexico during the 1950s. The original N-number appears to have been swapped over to another plane. Evidence consistent with this is that the young Arnold was photographed (see Fig. 24, Section 10) in CallAirs with different paint liveries (thanks to Mary Castner for pointing this out; personal email 12.07.2010) According to a note attached to this record of Arnold's number at <http://www.airport-data.com/aircraft/N33355.html> it belongs to an A-3 with a 6-cylinder Continental 125hp engine, but originally built in 1947 and "rebuilt almost from scratch" by its new owners in Idaho in 1968.

23 Arentz, B., *The CallAir*, FLYING Magazine, Jan 1950, p.32

24 Kilber, R., 'A Wing, a Prayer and a CallAir' *Custom Planes Magazine*, August 1999 p.28.

<http://ronkilber.tripod.com/callair/callair.htm>

http://en.wikipedia.org/wiki/CallAir_Model_A#Specifications_.28A-2.29

different propellor size and pitch. But the cruise speed is about the same in all variants, a little over 100mph. This figure fits Arnold's own statements (see Section 2.d).

Arnold described his turn and climb over Mineral as "slow and steady", which does not suggest urgency or the wish to consume a lot of fuel; but to be conservative let us assume that Arnold was in a maximum-power climb from having searched the canyon, achieving 1000ft/min in a climb ratio of 5:1, then neglecting winds²⁵ every 1000ft of climb takes him about 1.0 mile on the ground.

No early source tells us the altitude to which Arnold had descended in searching the canyon, but a very low altitude in the order of 100 ft or less over the slopes is implied by Arnold's recollection in 1978²⁶ which makes sense of his statement in 1977 that he broke off searching along the ridge side of the canyon and came over Mineral at about 2000 ft:

As I came out below on this first sweep I passed over the little community of Mineral, Washington, the pine trees there,²⁷ and knew pretty much where I was. I made a turn at probably 2000 ft over Mineral, Washington and started climbing back, slowly but steadily climbing, to gain sufficient altitude to go back on the high plateau again for another pass at this mountain.²⁸

The region around Mineral is at about 1400-1500ft AMSL so if Arnold turned above Mineral at 2000ft AMSL as indicated by altimeter, then he climbed 7200ft during his turn "over Mineral" before levelling off on a heading back to Mt Rainier. Alternatively, if he meant 2000ft AGL judged by Type 1 eyeball then he climbed 5800ft. So this climb would take him a *minimum* of between 5.5 and 7 minutes, and at ~60mph ground speed he would travel at least 5.5 to 7 miles on the ground before reaching 9200ft.

It makes no sense that Arnold would have consumed more than necessary of this distance in continuing directly west from Mineral when his destination lay *behind* him to the east of Mineral. He tells us that he made "a turn over Mineral",²⁹ "a turn of 180 degrees over Mineral",³⁰ or "a turn to the right and above the little city of Mineral",³¹ so it is difficult to see how he could possibly have been much *further* away from Mt Rainier than the town of Mineral by the time he levelled off at the top of this turn. He could in principle have turned in a tight spiral of chandelles directly above Mineral³² but this power manouver costs fuel and would not answer the description of a "slow,

25 Arnold reported that winds were "from the NW most of the way up", which was confirmed by McDonald from the Boeing Field (Seattle) evening radiosonde. Together with surface wind obs at Tacoma and Seattle of 5kt and 10kt respectively the profile suggests mean NW winds in the order of 10kt over the altitude range from surface to 10,000ft (see Appendix 2). The small effect of this mostly cancels out in the groundspeed calculation over 180° of climbing turn.

26 Describing flying the same route in 1948 to film the remains of the crashed Marine C-46 on the glacier, Arnold recalled: ". . . I didn't go up to the 14,000-foot level and come completely down the canyon as I did in '47 because the wind was so turbulent that day, and you can get trapped in some of those places. . . But in order to really search an area very thoroughly, you've got to go very slowly, you've got to watch out for your wind change, and you usually want to stay at least twenty-five to fifty, maybe seventy-five feet up to as high as a hundred feet up off the mountain. So, that's the reason I didn't really fly in to take a movie of the crash because it wasn't too important and the winds were getting pretty bad up there." Conversation with Kenneth Arnold, Feb 06 1978, Bob Pratt.

<http://www.ufoevidence.org/documents/doc1998.htm>

27 Mineral, distinctively sited on the south shore of Mineral Lake, had been a notable logging and mining town for decades because the area's "unusually heavy untouched timber [pine forest] and mining of many valuable minerals". (<http://www.headquarterstavern.com/>).

28 Arnold, K., "How It All Began" in Fuller, Curtis G., *Proceedings of the First International UFO Congress* [1977], Warner, 1980, pp. 17-29. See: <http://www.ufologie.net/htm/arnoldrepiuc.htm>

29 *Ibid.*

30 Arnold, K. and Ray Palmer, *The Coming of the Saucers*, Amherst 1952 p.10

31 Arnold, K., report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/CUFOS files)

32 The CallAir had a notably small radius of turn suitable for tight manouvering in narrow canyons (Arentz, B., *The CallAir*, FLYING Magazine, Jan 1950, p.32)

"steady" climb beginning *after* the turn, as clearly implied in Arnold's detailed early report.³³ So one would expect Arnold to have been have been a few miles east of Mineral by the time he completed his climb.

But since we wish to be conservative let us assume that this right-hand turn and climb of ~7 minutes was actually *all* executed on the far (western) side of Mineral, so that he completes the turn and climb with the plane levelling off at 9200ft with the nose pointed due East above (or abreast of) the town of Mineral, about 23 miles from the summit of Mt Rainier.³⁴ From this point there is then still a period of "two or three minutes" of uneventful cruise to go (equal to 3 - 5 miles at 100mph³⁵) before the first sighting, placing him conservatively only 18 - 20 miles (29 to 32km) WSW of the summit of Mt Rainier at that time (approx. point E in Fig.3) when the objects were first glimpsed far to the north "coming from [the direction of] Mt Baker".

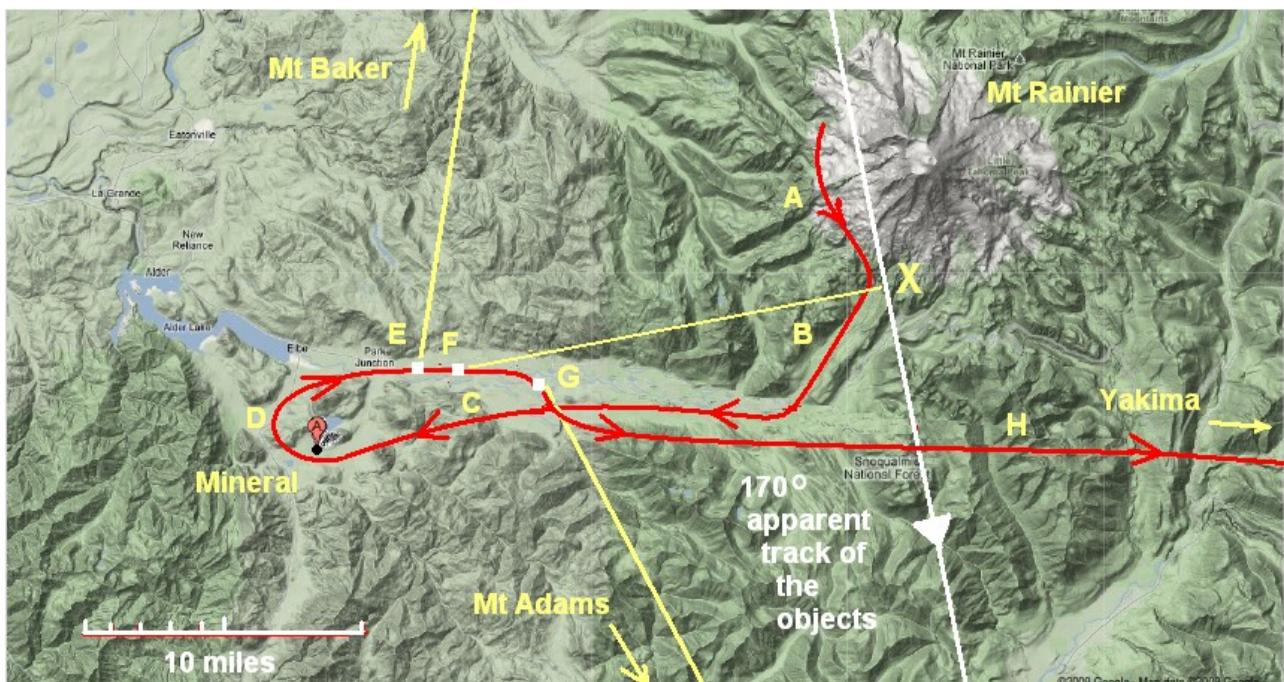


Fig.3. Approximate reconstruction of Arnold's likely course (see also Section 10.iv.b), showing lines of sight. Certain excursions from this course are not shown: Arnold indicates that he did not proceed very directly to Yakima afterwards (H) but spent at least some additional time on the look-out for the crashed C-46 and also took the opportunity to fly the length of a ridge south of Mt Rainier to measure the length of the formation of objects. There is considerable uncertainty about this sequence of events (see Section 7).

³³ Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/UFOS files)

³⁴ Arnold's locating of the turn "over Mineral" seems a more reliable fix than rough dead-reckoning based on time and distance; nevertheless a lazy turn a few miles to the West of Mineral would be plausible according to his early June 26 radio interview: "I came out of the canyon there, it was about 15 minutes [from Rainier] approximately 25 to 28 miles from Mount Rainier, [and] I climbed back up to ninety two hundred feet". A travel of 25 miles in 15 mins = ~100 statute mph (87kt), which is the CallAir's specified cruise speed. "25 to 28 miles from Mount Rainier" would be 3 - 5 miles West of Mineral. <http://www.ufologie.net/htm/arnoldrepsmith.htm> This would tend to fit our conservative model.

³⁵ This is a conservative ground speed. Nearest winds were generally NW, 19kt from 300° at 10,000ft (App.2), so it would be reasonable to assume an easterly vector component of 10kt, adding perhaps a further ½ mile of travel during 2-3 mins.

By the time they were crossing Arnold's course South of Mt Rainier (point *X* on Fig.3), Arnold's eastward flight had taken him closer by perhaps (still estimating conservatively) a further 1 minute or 1.7 miles (2.7km), to approximately point *F* on Fig.3. Thus his distance from a 170° object-track intersecting the summit of Mt Rainier would be on the *low* side of our bracketed 18 - 20 miles (29 to 32km).³⁶

But more importantly the objects seen passing low on the West side of Rainier against the snowfield were evidently at least some distance *less* than the *summit* of Rainier. This is a further argument that 18 to 20 miles (29 to 32km) must be a *maximum* distance from the objects.

The report that the range to the objects was back-stopped by the slopes of Mt Rainier is obviously fundamental to this conclusion. On its face the report seems unambiguous in this regard, but it has been questioned and the issue is important enough to merit more detailed discussion before we proceed.

36 Assuming a straight object course this is a maximum. The heading azimuth can only be significantly *larger* than 170° (i.e., rotated westward, not eastward) because of the limiting backstops of Mt Rainier and Mt Adams.

4) Did the objects fly behind Mt Rainier?

Before attempting to refine this result we should address an argument³⁷ that according to the earliest substantial written narrative purporting to be a quotation from Arnold, in the *Chicago Tribune*, the objects flew on the far, eastern, side of Mt Rainier proper.

"The first thing I noticed was a series of flashes in my eyes as if a mirror was reflecting sunlight at me," he said. "I saw the flashes were coming from a series of objects that were traveling incredibly fast. They were silvery and shiny and seemed to be shaped like a pie plate.

"I counted nine of them as they disappeared behind the peak of Mt. Rainier. Their speed was apparently so great I decided to time them. I took out my watch and checked off one minute and 42 seconds from the time they passed Mt. Rainier until they reached the peak of Mt. Adams, 50 miles to the south."³⁸

The phrase "behind the peak of Mt Rainier" taken literally would mean that the objects flew to the East of Mount Rainier. On the other hand it is possible that the quotation is inexact or incomplete and that Arnold actually said they disappeared "behind a peak of Mt Rainier", or behind "the [secondary] peak" elsewhere identified to the journalist in an unreported context (Sections 5 & 6).

One might wish to insist that a passage placed in quotes ought to be accepted as verbatim unless there is specific evidence of inaccuracy, in which case it is worth noting that the above newspaper account contains an apparent inaccuracy in the phrase "I took out my watch". Here is an extract from the early detailed report to the Army Air Force typed by Arnold himself about July 04 1947:

I remember distinctly that my sweep second hand on my eight day clock, which is located on my instrument panel, read one minute to 3 P.M. as the first object of this formation passed the southern edge of Mt Rainier . . . As the last unit of this formation passed the southernmost high snow-covered crest of Mt Adams, I looked at my sweep second hand and it showed that they had travelled the distance in one minute and forty-two seconds.³⁹

Here, and in his book,⁴⁰ Arnold described timing the objects using his cockpit instrument clock, specifically *not* his watch, which in any case he says was a "wristwatch", not a pocket watch, and thus would not be "taken out". He did, it is true, say in an early radio interview broadcast on the afternoon of June 26 1947,⁴¹ the same day the *Tribune* article appeared, that "I looked at my watch", but only after having just described "clocking them on my sweep second hand clock" so this is most likely also an aberration. All other written sources known to the author quote Arnold as using his cockpit clock. On balance, then, the *Tribune* quote probably cannot be relied upon in every particular, and we would be rash to radically reinvent Arnold's narrative on the basis of the difference between a definite and an indefinite article in a newspaper story.

37 Sparks, B., UFO UpDates list post, 11 Apr 2000; PROJECT-1947 mailing list post, 29 June 2009

38 *Chicago Tribune*, June 26 1947, p.1 (NICAP/CUFOS files)

39 Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/CUFOS files)

40 "An eight day clock with a sweep second hand is one of the essentials in my aircraft . . . I recall that when the first craft of this formation jetted to the southward from the snow-based cleft of Mount Rainier my second hand was approaching the top of my hour dial and the time was within a few seconds to one minute of three. I can't distinctly remember whether the eight day clock on my instrument panel was set on Pacific time, Mountain time, daylight saving time or slow time. *I never thought of checking this with my wristwatch.* I believe my eight day clock was on Mountain time [emphasis added]" (Arnold, K. and R.Palmer, *The Coming of the Saucers*, Amherst Press, Wisc. 1952, pp.9-11)

41 Interview of Kenneth Arnold by Ted Smith, KWRC radio, Pendleton, broadcast June 26, 1947

However there may be other evidence. An undated pencil sketch⁴² done by Arnold on the back of a heavy-duty 12½" x 9½" manila business envelope (see Fig.4) has been adduced in support of the argument that the objects travelled behind Mt Rainier.⁴³ But this conclusion is at best ambiguous. It is based on the premise that the pencil line marked "10,000'" commences (looking from left to right) at the South edge of Mt Rainier; and that this line depicts the objects' apparent trajectory emerging from behind the mountain (Arnold estimated their initial height when they were approaching Rainier from the north as about 9,500ft).

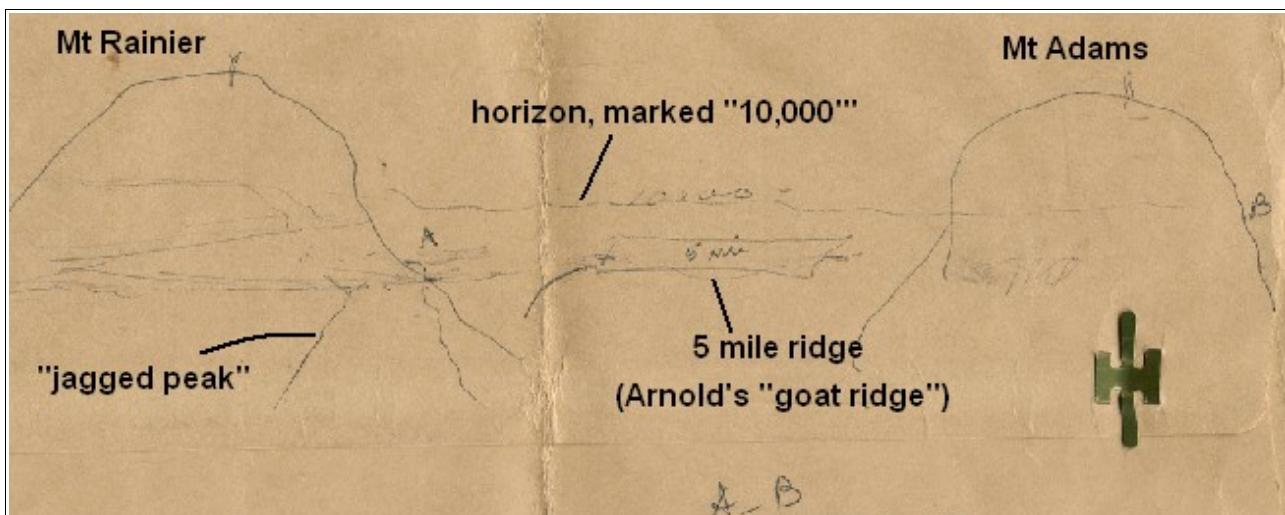


Fig.4 Part of an undated sketch by Kenneth Arnold on a manila envelope bearing the address label of his Western Fire Control company. Text added here to indicate various features. A and B represent the points between which Arnold clocked the objects. (NICAP/CUFOS files; courtesy Mary Castner, CUFOS).
Compare Fig.12, Sect.6. See also Appendix 4

Firstly, close examination of the sketch shows that the impression of a line beginning at the south edge of the mountain is not unequivocal. The line is arguably a continuation of a line (or pair of lines) sketched across the mountain at the same level, but curving down and breaking before reaching the edge. This alignment could be mere coincidence, in which case it might be possible to interpret the lines across Rainier as representing the glacial canyons. But there is also an underlying very faint line running across the face of the mountain and continuing beyond the southern edge well past the letter "A", connecting the broken ends (see Fig.5). This seems to me to indicate something about Arnold's intention.⁴⁴

Secondly, the theoretical motivation for wishing to send the path of the objects behind Rainier is Philip Klass's theory that the objects were a train of distant daytime meteors⁴⁵, but this gets us into trouble with the very same drawing which unequivocally shows this hypothetical line of flight crossing in front of Mt Adams (see Fig 4). What is sauce for the goose being sauce for the gander, then if the claimed *absence* of a line across Rainier is to signify the path of the objects *behind* the mountain then the evident *presence* of the same line across the front of Adams ought to signify a

⁴² The envelope is fairly old, certainly pre-1977, but details of its manufacture and address labels are not definitely inconsistent with any date prior to about 1970. See Appendix 4.

⁴³ Sparks, B., UFO UpDates list post, 11 Apr 2000.

⁴⁴ Of course, whatever the distance to the objects, and whichever side of the mountain they flew, the southern edge of Mt Rainier is very significant for Arnold since this is the point from which he began to clock their speed - his point A on the sketch. It may seem unsurprising, therefore, if he emphasised with a heavier stroke the start of this interval at A.

⁴⁵ K lass, P. J., *Were Kenneth Arnold's UFOs Actually Meteor-Fireballs?* Skeptics' UFO Newsletter #46: July 1997.

path *in front* of the mountain.⁴⁶ So in terms of the meteor theory the interpretation of this line as the objects' visible path is internally incoherent as well as being in contradiction with explicit testimony (see Section 5).

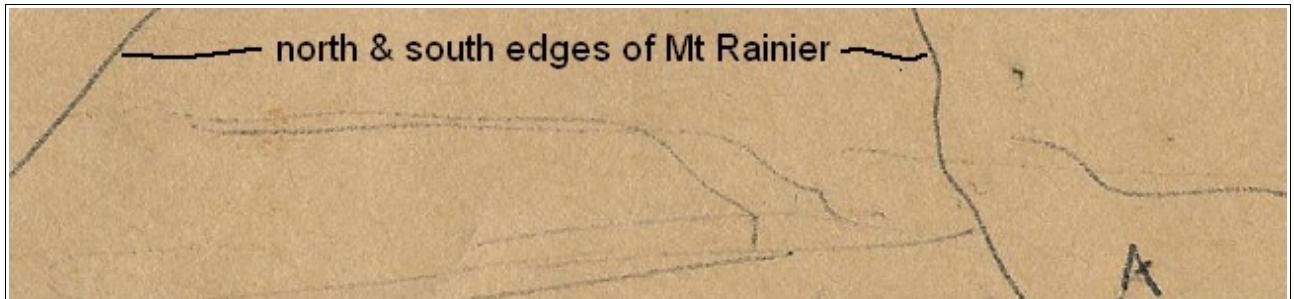


Fig.5 Enlarged detail from Fig.4. The faint underlying line crossing the face of the mountain and connecting the more heavily-sketched broken lines is just visible in this scan.

As a representation of the object trajectory that Arnold described, however, the 10,000ft line (or complex of lines) does make sense. The whole formation departed "by as much as a thousand feet up or down" from its average height, sometimes going "down into the canyons"; but roughly speaking the objects appeared level with the terrestrial horizon - which Arnold *believed* (but see below) must indicate that they were straddling his own altitude level of about 9200ft. (In fact he gave several nominal estimates of object height, including, in his AAF report, "9,500ft"⁴⁷, and as quoted in several different wire and newspaper reports within 48 hours of the event, "9,500 - 10,000ft" and "10,000ft".⁴⁸ The echelon formation of the objects had a certain vertical spread, of course (whether due to stepped altitude, or to the perspective projection of a flat right-echelon, or to some combination of both, being not known *a priori*); in addition to which Arnold would have realised that his own altimeter reading was only approximate.⁴⁹) Thus, the downward-curving break in the darker 10,000ft line(s) where it approaches the right hand side of the mountain would be Arnold indicating that whilst the average height of the lead object(s) was a little above the horizon at a level which Arnold guessed to be about 10,000ft (see Fig.12, Section 7) the hindmost members of the chain trailing below the horizon disappeared into the cleft behind the "jagged peak". The tilt of the "5-mile-long" chain of objects appears to be indicated by the slanting line drawn by Arnold across the face of Mt Rainier on the left (its scale being roughly comparable with the 5-mile-long ridge sketched to the right). From the bottom of this slanting line another line makes a swooping curve to the right, shown emphatically passing behind a rough-topped triangular feature (presumably the "jagged peak" behind which "the rear two or three objects dipped down" as he told McDonald⁵⁰) before crossing the edge of Mt Rainier below the letter "A" and heading out towards

46 As it seems it does according to Arnold's early (and late) accounts, e.g. "I could see them against the snow, of course, on Mt. Rainier and against the snow on Mt. Adams as they were flashing, and against a high ridge that happens to lay in between Mt. Rainier and Mt. Adams." (Interview of Kenneth Arnold by journalist Ted Smith, broadcast on KWRC radio, Pendleton, on June 26, 1947). J.E.McDonald sought to check this in his Nov 19 1966 interview with Arnold. His notes record: "Were west of Mt Adams, seen against the slopes." (McDonald papers, University of Arizona; NICAP/CUFOS files, courtesy Mary Castner, CUFOS)

47 Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/CUFOS files)

48 E.g., Pendleton (Oregon) *East Oregonian*, June 25 1947, p.1; Pendleton, Ore. (AP) June 25, *Star Telegram*, June 26 1947; Pendleton, Ore. (AP) June 25, *Arizona Republic*, June 26 1947 p.13; Pendleton, Ore. (AP) June 26 1947, *New York Sun* June 26, 1947; Chicago *Tribune*, June 26 1947 p.1

49 Because the last pressure setting had been made at Chehalis, Washington, an hour earlier. See Section 3.

50 McDonald, J.E., letter to Dr Richard J Reed, Department of Atmospheric Sciences, University of Washington,

the 5-mile ridge (see Section 7 and details in Figs.10a & 10b).

The horizon line was of significance to Arnold. It was by reference to the horizon that Arnold concluded he was approximately co-altitudinal with the objects:

"I would estimate their elevation could have varied a thousand feet one way or another up or down, but they were pretty much on the horizon to me which would indicate they were near the same elevation as I was."⁵¹

I knew that I was on a level with them because thy were on a horizon with me, so my altimeter showed a little over 92 hundred feet, so they were flying at an elevation of about 92 hundred, probably a little less or a little more as they sort of undulated, if you want to call it that, as they flew.⁵²

Of course this was only approximately correct. An object co-altitudinal with Arnold would approach alignment with the *terrestrial* horizon only if it were at great distance, two hundred miles or more. Obviously Arnold's objects were ten times closer than this and if truly co-altitudinal would appear aligned on the *astronomical* horizon. The astronomical horizon is 90° from the zenith and seen from Arnold's aircraft would be approximately 1.6° above the terrestrial horizon.⁵³ This is a dip angle 3 times the diameter of the moon. The angle would be difficult to judge, especially with an undulating formation of objects on a mountainous skyline where the formation is itself spread over a certain vertical visual angle. But we should note that a line of sight towards Arnold's terrestrial horizon would intercept Mt Rainier significantly below his 9200ft altitude, suggesting that at least some of the objects were considerably lower than the figure Arnold guessed. As we will see (Section 6) this tends to fit the dictates of the topography and of Arnold's own drawing.

Seattle, Nov 29 1966 (U. of Arizona; NICAP/UFOS files)

51 Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/UFOS files)

52 Arnold, K., "How It All Began" in Fuller, Curtis G., *Proceedings of the First International UFO Congress* [1977], Warner, 1980, pp. 17-29. See: <http://www.ufologie.net/htm/arnoldreplic.htm>

53 The geometrical horizon dip angle (d_g) = $\sqrt{(2h/R)}$ radians, where R is the Earth's radius and h is the height of the eye above the surface, so from 9200ft altitude the apparent horizon neglecting refraction is 0.0296 rad or 1.695° below the astronomical horizon. Corrected for refraction assuming a standard atmosphere we get (d_g) = ~1.58°.

5) Pinning down the objects' position in relation to Mt Rainier and to Arnold

They were seen for some length of time against the background of the mountain, flying "not more than 500 feet over the plateau"⁵⁴ for a period long enough to be "observed quite plainly"⁵⁵ as distinctive shapes - black and intermittently reflective - against the snowfields. The *average* angular rate of the measured 102-sec transit (~80deg; see Fig.13)) from Mt Rainier to Mt Adams is about 0.8°/sec., but the peak angular rate for a constant true groundspeed would occur in the vicinity of Mt Rainier, becoming slower towards the north and (especially) the south extremes of the track. Thus 0.8°/sec should be taken as a conservative estimate. Let's just say the rate is in the order of 1.0°/sec, then the duration of each object's transit of the snowfields of Rainier at the ~9000ft level would be in the order of 10 seconds, allowing a reasonable opportunity for inspection as reported.⁵⁶

A transit of 10 seconds also seems to allow adequate time for Arnold's claim that they (or some of them) vanish "momentarily" behind a secondary peak then reappear against the snow of Mt Rainier proper. This latter claim appears to be recorded in the earliest news sources. On June 26 1947:

He said he could estimate the distance of the objects better because an intervening peak once blocked his view of them. He found the peak was [20 to] 25 miles away, he related. The Boise flyer said they flew on the west sides of Rainier and Adams.⁵⁷

Another paper:

I counted nine of them as they disappeared behind [a] peak⁵⁸ of Mt. Rainier.⁵⁹

On the same day Arnold told listeners to KWRC radio in Pendleton:

. . . I would say that they even went down into the canyons in several instances, oh, probably a hundred feet, but I could see them against the snow, of course, on Mt. Rainier.⁶⁰

This last is ambiguous as "the canyons" *could* refer here to the later flight along the hogsback ridge south of Mt Rainier, called "Goat Ridge" by Arnold (see Section 7), as also could his July 8 narrative for the AAF:

They seemed to hold a definite direction but rather swerved in and out of the high mountain peaks . . . I could quite accurately determine their pathway due to the fact that there were several high peaks that were a little this side of them as well as higher peaks on the other side of their pathway.

But three days later he was again quoted thus in the press:

I reckoned the saucers were 23 miles away, because they flew behind one of the peaks of Mt. Rainier, I can show on the map exactly where the peak is and where I was.⁶¹

54 Pendleton, Oregon, *East Oregonian*, June 27 1947

55 Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/CUFOS files)

56 The true altitude was almost certainly lower and the duration of transit of the mountain cone therefore longer. Note also that although the transit occurs near the peak angular rate it also occurs near the peak angular size.

57 Pendleton, Oregon, *East Oregonian*, June 26 1947

58 See Section 4.

59 *Chicago Tribune*, June 26 1947

60 Interview of Kenneth Arnold by journalist Ted Smith, broadcast on KWRC radio, Pendleton, on June 26, 1947

61 Portland *Oregonian*, July 11, 1947



Fig.6 Detail from topographical map sent by Dr J. E. McDonald to Arnold, Nov 10 1965, with request that he indicate the area of the jagged peak behind which objects flew. Pyramid Peak circled (whether by Arnold himself, or by McDonald after discussion with Arnold, is not clear). Crystal Mt is just to the south. (McDonald papers, U.of Arizona; NICAP/CUFOS files, courtesy Mary Castner)

And his 1952 account is equally explicit:

I knew where I was and they revealed their true position by disappearing from my sight momentarily behind a jagged peak that juts out from the base of Mount Rainier proper.⁶²

In 1966 Dr James McDonald interviewed Arnold at least twice and the following year wrote to an author (probably Ted Bloecher⁶³) as follows:

Near the end of paragraph you [sic] imply the objects passed behind 'Goat Rocks' (that is proper identification for them). I discussed that in some detail with Arnold and believe I have it correct that the peak was an outlier on the southwest flank of Mt. Rainier.⁶⁴

This is reinforced in Arnold's own 1977 recollection:

62 Arnold, K., and R. Palmer, *The Coming of the Saucers*, Amherst, Wisconsin, 1952, p.12

63 McDonald was writing an Introduction to Bloecher's *Report on the UFO wave of 1947*, privately produced, 1967.

64 McDonald, J.E., letter, probably to Ted Bloecher, 07 Sept 1967 (NICAP/CUFOS files, courtesy Mary Castner, CUFOS)

. . . actually they disappeared behind a sharp projection on Mt. Rainier in the snow field to my eyesight. And, since I knew approximately where I was, flying of course toward the mountain, I knew where they had passed.⁶⁵

Some critics have objected that there are no suitable projecting secondary peaks on the SW side of Mt Rainier (see Section 6) and that Arnold's impression must therefore have been an illusion. Kottmeyer suggested that perhaps such an illusion was caused by the objects momentarily presenting a profile aspect so narrow that they were lost to sight.⁶⁶ Easton then attempted to interpret Arnold's "jagged peak" or "sharp projection" as the prominent secondary peak called Little Tahoma on the SE side of the mountain,⁶⁷ arguing that because numerous explicit early statements by Arnold have the objects crossing the snowfields on the *west* side of the mountain, they could not possibly have gone behind Little Tahoma, and that therefore Arnold *must*, as Kottmeyer had conjectured, have been mistaken about seeing them go behind his "jagged peak".

In large part these problems can be laid at the door of a tendency to neglect the apparent vertical spread of heights due to the reported stepped echelon formation, and a somewhat literal acceptance of Arnold's estimate of ~9000ft altitude based on his apparent horizon. There are indeed no very suitable peaks near 9000ft. But as advertised in Section 4 we will find that in the course of more realistically qualifying this altitude estimate a consistent scenario emerges.

65 Arnold, K., "How It All Began" in Fuller, Curtis G., *Proceedings of the First International UFO Congress* [1977], Warner, 1980, pp. 17-29

66 E.g., Kottmeyer, M., *Resolving Arnold - Part 2: Guess Again*, REALL Newsletter July 1997
<http://www.reall.org/newsletter/v05/n07/resolving-arnold-part-2.html>

67 Easton, J., Voyager Newsletter - Issue No. 10, UpDates mailing list April 08, 2000.

6) Can we identify the "jagged peak" and "snow-based cleft" on Mt Rainier?

The issue was raised by McDonald in a letter⁶⁸ to Arnold dated Nov 10 1966:

A point of particular importance is that of the approximate distance to the objects, so your recollections concerning the passage of some of them behind a peak is of great interest. Some accounts say the objects were swerving in and out around the peaks, but I gather from your phone comments that there was only one instance in which such an event occurred, and that not all nine objects passed behind the peak even then. Is that a correct impression? Do you recall how many did go in back of the peak? I went over to our Library map section and obtained Xerox copies of the Mt. Rainier topographic charts. One copy is enclosed. As I understood, the jagged peak was only a few miles roughly SW from Rainier. ~ Looking at this chart, could you identify the peak in question? I don't spot any that would involve a saddle at elevation near 9000 ft. Do you suppose the elevation was lower than that, and that the altitude of the objects was, correspondingly, well under 9000 ft or could there be any other explanation, such as a location of the peak to some other direction than SW from Rainier? One of my colleagues, who is from Washington, reading some of the published accounts I have in my files also wondered if perhaps the peak behind which some of the objects disappeared might have been well south of Rainier, perhaps near Goat Rocks.⁶⁹

Arnold's letter of reply apparently does not survive, but McDonald's papers contain a copy of the topographic map mentioned above on which Pyramid Peak has been circled by hand (see Fig.6). To an academic colleague two weeks later McDonald wrote "after still further discussion with Arnold":

We went over the question of what "small jagged peak" they went behind. - (I'd mailed him a Xerox of a topographic chart of Mt. Rainier and asked him to locate it.) He thinks the rear two or three objects dipped down in the saddle behind Pyramid Peak. He also confirmed that some of the objects (rearward ones) passed between him and Mt. Adams as they moved out of sight.⁷⁰

Extracts from McDonald's notes of a telephone interview with Arnold on Nov 19 1966 record his concern to pin down this point:

Peak is probably S + W of Rainier. Might have been Pyramid Peak, or Iron peak or Crystal Mt. He flew on June 24 1948, took movies, and peak definitely shows up. Reflew Goat Ridge to check the calibration of the length (5 mi) of chain . . . The ΔZ from Crystal Mtn (6306') to saddle between it + Pyramid Pk (6937') is about 700ft (saddle \approx 5600' max). And just N of Pyramid Pk. the saddle is close to 6000' so there the $\Delta Z \approx$ 900ft. Thus either of these saddles might have been the gaps through which the rear objects passed.⁷¹

Today we have the benefit of modern digital elevation models that allow detailed 3D topographic renderings such as those available on Google Earth, and before learning of the above-mentioned notes the present author identified a feature that seemed to fit well Arnold's description of "a jagged peak that juts out from the base of Mt Rainier proper" forming a "snow-based cleft" SW of the summit through which aircraft might have flown. This cleft is located at 46.82783583802056W

68 McDonald, J.E., letter to Kenneth Arnold, Nov 10 1966 (McDonald papers, University of Arizona; NICAP/UFOS files, courtesy Mary Castner, UFOS)

69 A complex of high ridges about 50 miles SSE of Mt Rainier later identified by Arnold (though not certainly; see Section 7) as the feature he used to scale the length of the chain of objects.

70 McDonald, J.E., letter to Dr Richard J Reed, Department of Atmospheric Sciences, University of Washington, Seattle, Nov 29 1966 (U. of Arizona; NICAP/UFOS files)

71 McDonald papers, University of Arizona; NICAP/UFOS files, courtesy Mary Castner, UFOS

121.8165918743094N and lies behind a sheer 400 ft ridge that rises out of the middle of the Tahoma Glacier. The peak it lies behind, Glacier Island, is not the same one referred to by Arnold and McDonald but is nearby, about 1 mile NNW of Pyramid Peak across the trench of the South Tahoma Glacier and about 750ft higher.

Fig.7 shows a view of the Glacier Island cleft as it would appear from the approximate position of an aircraft approaching on a ~170° heading towards Mt Adams. Fig.8 is a look back at the cleft after passing through. And Fig.9 shows the hypothetical situation from a position a few miles SSW of the cleft.

Described as "a jagged 7,690 feet (2,344 m) high sub-peak of Rainier",⁷² Glacier Island fits the report rather well. Arnold definitely said they were much lower than the summit, specifically over the "plateau", by which we know that Arnold means "the high plateau from which Mt. Rainier rises".⁷³ They were, he is quoted as saying, flying low over the snow of Mt Rainier "not more than 500 feet over the plateau".⁷⁴ The top 2-3000ft of the main peak tends to be unglaciated and relatively clear of snow especially on the west side (see, e.g., Fig.9) because of gradient, windscouring and the lower precipitation rates at heights above about 12,000ft, and the permanent year-round snowline averages about 6,500ft,⁷⁵ but could be lower because climatically speaking June is still early summer on Mt Rainier. Arnold himself gives us further information to calibrate the altitude of the snowline: "I observed the chain of these objects passing another high *snow-covered* ridge in between Mt Rainier and Mt Adams [emphasis added]".⁷⁶ These peaks are much lower than Mt Rainier, generally less than about 6-7000ft, indicating that the snowline on June 24 1947 was significantly below 7000ft.⁷⁷

72 http://en.wikipedia.org/wiki/South_Tahoma_Glacier

73 "I had made one sweep [at 9500ft] of this high plateau to the westward [of Mt Rainier], searching all of the various ridges." Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/CUFOS files)

74 *Oregon Journal*, 27 June 1947

75 www.mountainguides.com/pdf/Rainier_Natural_History.pdf

76 Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/CUFOS files)

77 In 1967 McDonald commented: "He [Arnold] states in one version that they [the peaks of the lower ridge] were snow-covered, but I believe that's quite doubtful for that time of year." (letter, 09.07.67, probably to Ted Bloecher, NICAP/CUFOS files; courtesy Mary Castner). McDonald does not justify this remark. The average permanent snowline on Mt Rainier is at or below the summit heights of several Cascade ridges, including the Goat Rocks massif which is itself glaciated indicating areas of permanent snow. According to one trekking guide. "Glaciers rest in snowy repose" on Goat Rocks, "while chilled streams careen down from high ridgelines. . . . the weather here can be volatile (don't even think of coming until mid-July)" (http://www.gorp.com/parks-guide/travel-ta-goat-rocks-wilderness-area-portland-hiking-sidwcmdev_054752.html) Snow/ice cover in late June does not sound too unlikely. A 1965 study of glacial mass changes in the North Cascades discovered a loss rate in low-level ice of 0.6 metres per year for the period 1945-65, meaning that the low-level glaciers had shrunk back since the time of Arnold's sighting. (Tangborn, W. V., 'Mass Balances of Some North Cascades Glaciers as Determined by Hydrologic Parameters, 1920-1965', U.S. Geological Survey, Tacoma, Washington <http://iahs.info/redbooks/a079/079024.pdf>). Moreover, northern hemisphere spring snow cover has declined by about 8% over the period 1922–2005 (Lemke, P., et. al., 'Changes in Snow, Ice and Frozen Ground.' in: *Climate Change 2007: The Physical Science Basis, Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, edited by: Solomon, S., et al., Cambridge University Press, 2007.) Because it shows mainly in the 0°C to 5°C isotherm range this trend especially affects the "warm snow" (0-3°C) that forms much of the low-level snowpack in the Cascades, and estimates indicate "a substantial (roughly 15–35%) decline from midcentury to 2006" (Mote, P. et al., 'Has spring snowpack declined in the Washington Cascades?', *Hydrology & Earth System Sciences*, 12, 193–206, 2008. <http://www.hydrol-earth-syst-sci.net/12/193/2008/hess-12-193-2008.pdf>). And finally, on top of the long-term declining trend in low-level spring snow the year 1947 fell in a short-term snowy period that peaked in about 1950 after a trough at the start of the decade. Spring snowpack then declined again until another trough was reached in about 1960 after which it grew towards a peak in the early 1970s (*ibid.*). Precipitation in Washington in June 1947 was 180% of the monthly average, and temperature below normal (Seamon, L.H., 'The Weather of 1947 in the US', *Monthly Weather Review*, Vol. 75, No. 12, December 1947). So the June snowline is very likely to have been lower in 1947 than today, and in particular lower than in the period that would have informed McDonald's 1966 comment that Arnold's report of the snow level seemed "unlikely".

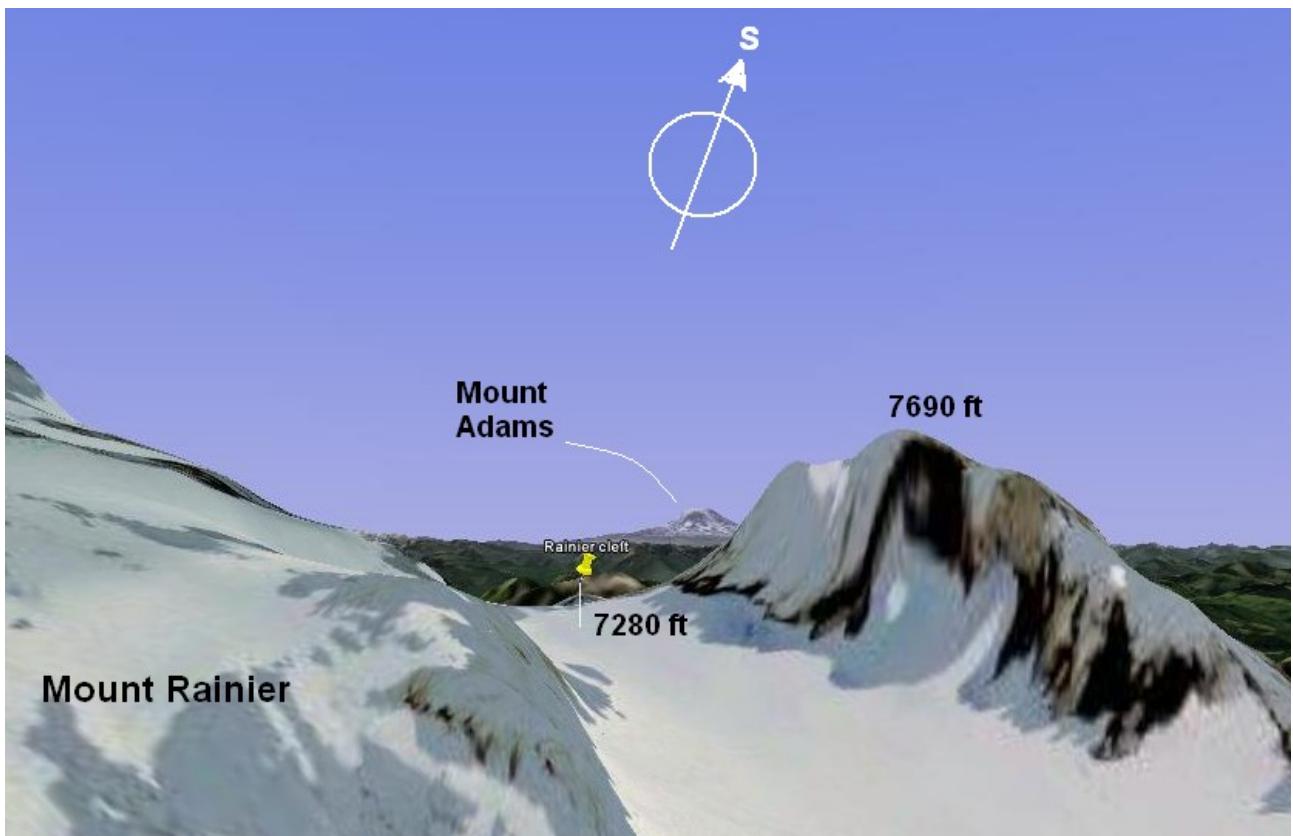


Fig.7 Glacier Island cleft from the NNW looking through to Mt Adams in the distance . . .



Fig.8 . . . and looking back from the SSE (Google Earth images)

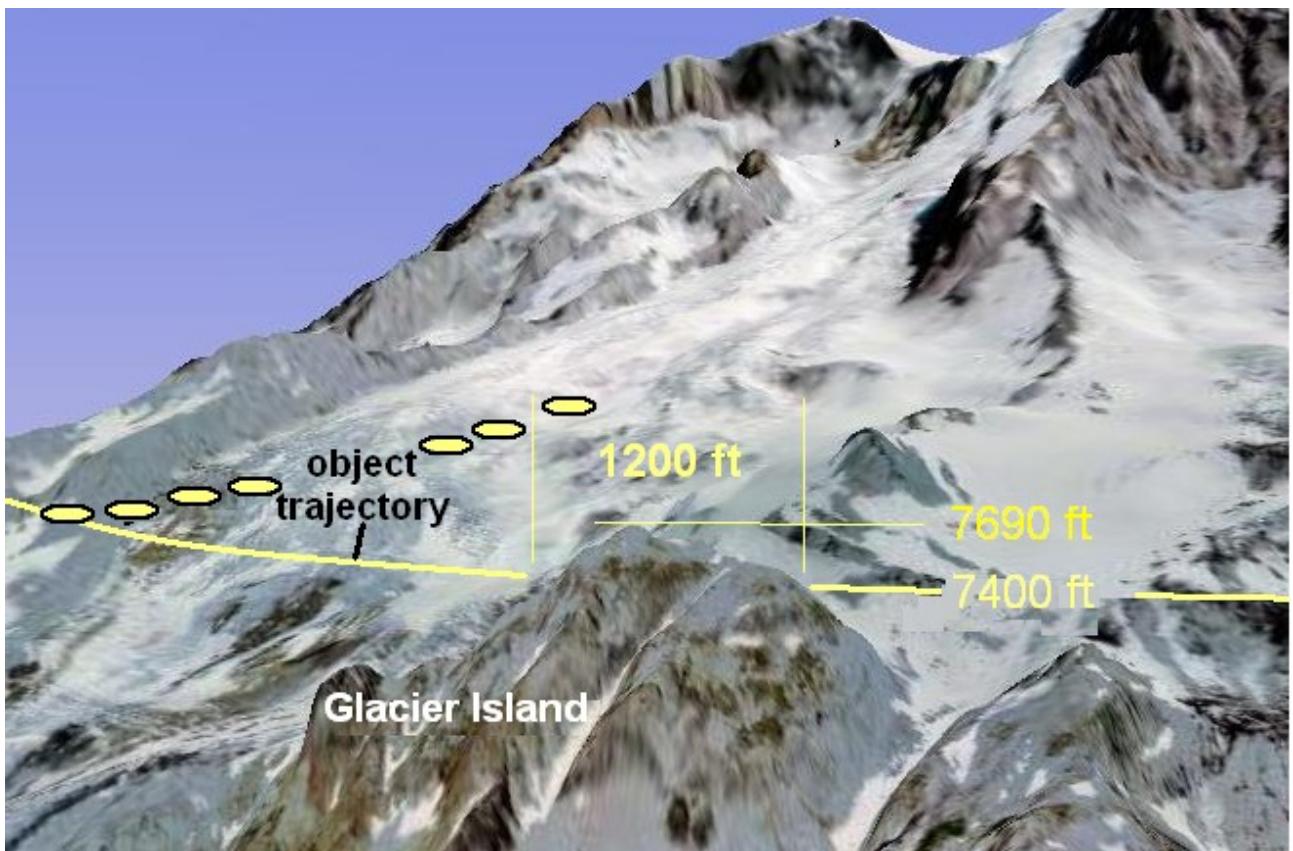


Fig.9. Close up of Glacier Island and the bulk of Mt Rainier from the SW, showing approximate implied trajectory of the chain (stylised and not to scale) of objects clearing the floor of the cleft by about 100ft (Google Earth image)

Thus we should expect the objects to have passed the snowy/glacial backdrop of Rainier somewhere between about 6000 ft and 12,000 ft. This fits Arnold's ~9000-10,000ft estimate but could also fit a lower position on the glaciated sloping "plateau" or shield of the mountain near Glacier Island.

Others such as Bruce Maccabee have pointed out⁷⁸ that because the heights of peaks on the mountain ridge between Mt Rainier and Mt Adams (known to Arnold as Goat Ridge; see Section 7) are only 5000 ft to 7000 ft, objects that appeared to "hug" the terrain unusually close to these summits were probably lower than Arnold thought. Maccabee observes that the dip angle of the horizon could be difficult to judge in the circumstances, which fits the inference we have made (see Section 4) from Arnold's manilla envelope drawing in Fig.4.

The Glacier Island cleft is about 3 miles from the summit. So subtracting as much as 3 miles from the distance figures in Section 3, which were measured from the summit, we conclude that Arnold could easily have been within 16-17 miles (26-27km) of the objects when they passed Mt Rainier.

Arnold said the objects "jetted to the southward" from the cleft "hugging the mountain tops" and "swerving in and out of the peaks", appearing more or less "on the horizon". Clearly the "hugging" and "swerving" is being done by the lower objects in the formation ("the rear two or three objects dipped down in the saddle", said Arnold to McDonald) which have just exited from the cleft. Notably, from the observer position and altitude described in Section 3, Glacier Island peak appears almost exactly level with the terrestrial horizon. This is evident from the digital simulation in

78 <http://www.brumac.8k.com/KARNOLD/KARNOLD.html>

Fig.12, and as a rough cross-check on the consistency of our construction we note that a horizon depression angle of -1.58° (see Note #52) = 2280ft of altitude at a distance of 16 miles, placing the apparent horizon roughly on a level with the 7000ft mark on Mt Rainier, which is reassuringly close to the 7300ft altitude of the base of the "cleft" behind Glacier Island. (For comparison, if Arnold was 23 miles from the objects the horizon level would appear aligned with the 5800ft level on the mountain, not quite such a good fit.)

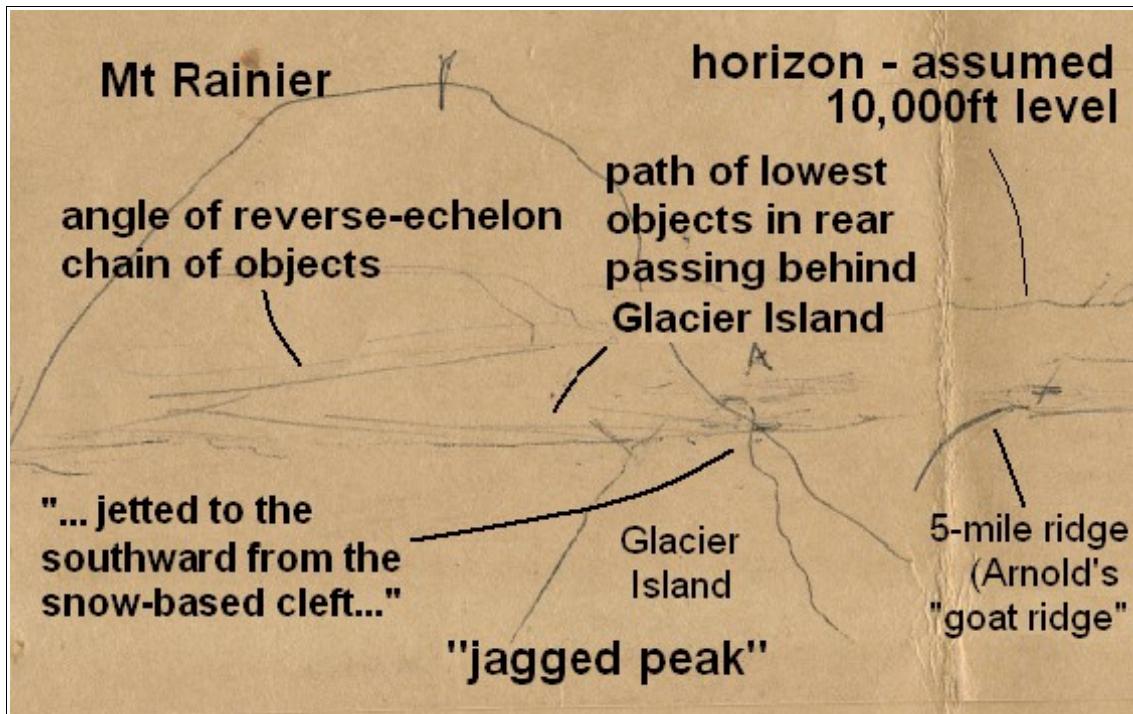


Fig.10a. Enlarged detail from Fig.4 showing known and suggested meanings of various features

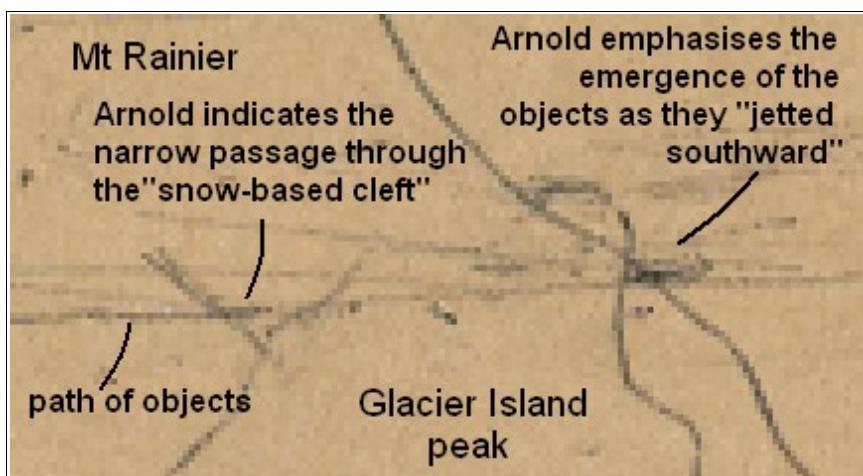


Fig.10b. Further enlarged detail of peak and cleft from Arnold's sketch

In summary, this identification of Glacier Island as Arnold's peak seems at least very plausible. It is not proven, but absent any equally plausible alternatives this is an identification for all practical purposes. Of the various contenders suggested over the years by others such as McDonald and Arnold himself - Pyramid Peak, Crystal Peak and Iron Mountain - none seems to compete with Glacier Island in terms of its combination of properties - altitude above the permanent snow/glacier line, horizon elevation, position, angular breadth and vertical prominence.

As mentioned briefly in Section 5 an argument was made in about 1997-2000 for another candidate, Little Tahoma Peak. Whilst ostensibly unattractive, this idea has been fairly influential because of its context (a much-discussed attempted explanation of the sighting; see Section 10.iv.) and so deserves to be considered in detail for completeness.

In 1997, researcher Martin Kottmeyer attempted to locate some suitable feature near Arnold's estimated "9,200ft" horizon level and reported the "neat little surprise" that no such feature existed on the west side of the mountain. Kottmeyer mentioned the peaks earlier discussed by McDonald and Arnold, only to dismiss them as far too low for the purpose. The only candidate at the right altitude seemed to be Little Tahoma, at about 10,000ft, but it was on the wrong (SE) side of the mountain, and Arnold's objects, passing west of the mountain, could not have flown behind it. Kottmeyer speculated that the apparent occultation had been an illusion.⁷⁹

Following Kottmeyer, James Easton later reasoned like this: If Little Tahoma is the only possible feature behind which Arnold could have seen the objects apparently vanish, and if it is geometrically impossible for this to have happened, then Arnold must really have seen them pass in front of Little Tacoma and all other parts of Mt Rainier, in which case the objects might have been many miles closer than he thought, therefore very much smaller, and very much slower.⁸⁰ Three months later Easton circulated⁸¹ what purported to be photographic proof of the identity of Arnold's peak: Two photographs clearly showing Little Tahoma standing proud of the shoulder of Mt Rainier, one of which "seems to have been taken from the same [Arnold's] perspective." (Fig.11.e)

The logic is unassailable, but the premises of the argument are flawed. The premise that the "jagged peak" must be at 9,200(± 1000)ft is invalid because it is based on an improper understanding of the terrestrial horizon dip angle, as we have already shown above; and the premise that Little Tacoma could have been visible from Arnold's position at 9,200ft near Mineral, Washington, is easily disproved. The latter problem was pointed out to Easton by one of his own expert mountaineering informants, but he glossed over the point. Today we can explore the 3D digital terrain in Google Earth and prove that Little Tahoma cannot be seen at all from anywhere near Arnold's location. The elevation of the peak of Little Tahoma above the far horizon in Easton's photo proves that it was taken from a comparable (or lower) altitude, whilst its prominence and the mountain profile proves the camera was to the SSE (Fig.11.e), more than 90° of azimuth away from Arnold's LOS.

From Mineral Arnold would have to have flown south-southeast (at right angles to his line of sight to Mt Rainier) for about 4 mins (much longer than the entire sighting duration) at 100mph, changing his bearing from Rainier by about 15°, before even the very tip of Little Tahoma began to peep above the shoulder of the mountain (Fig.11.b). In order for Little Tahoma to have started to become a notable feature (in Fig.11.c it has revealed ~800ft of its peak, ~30arcmin of prominence at Arnold's distance) Arnold would have to have flown about as far again in the same direction. In other words, the basic defect in Easton's hypothesis is about 30° of bearing angle or more than 13 miles of lateral position.⁸²

79 Kottmeyer, M., *Resolving Arnold - Part 2: Guess Again*, REALL Newsletter July 1997
<http://www.reall.org/newsletter/v05/n07/resolving-arnold-part-2.html>

80 Easton, J., Voyager Newsletter - Issue No. 10, UpDates mailing list April 08, 2000.

81 Easton, J., Voyager Newsletter - Issue No. 13, July 2000

82 In addition, the lowest of the tilted chain of nine objects would have to be more than 1. 0° or two (cont. over)

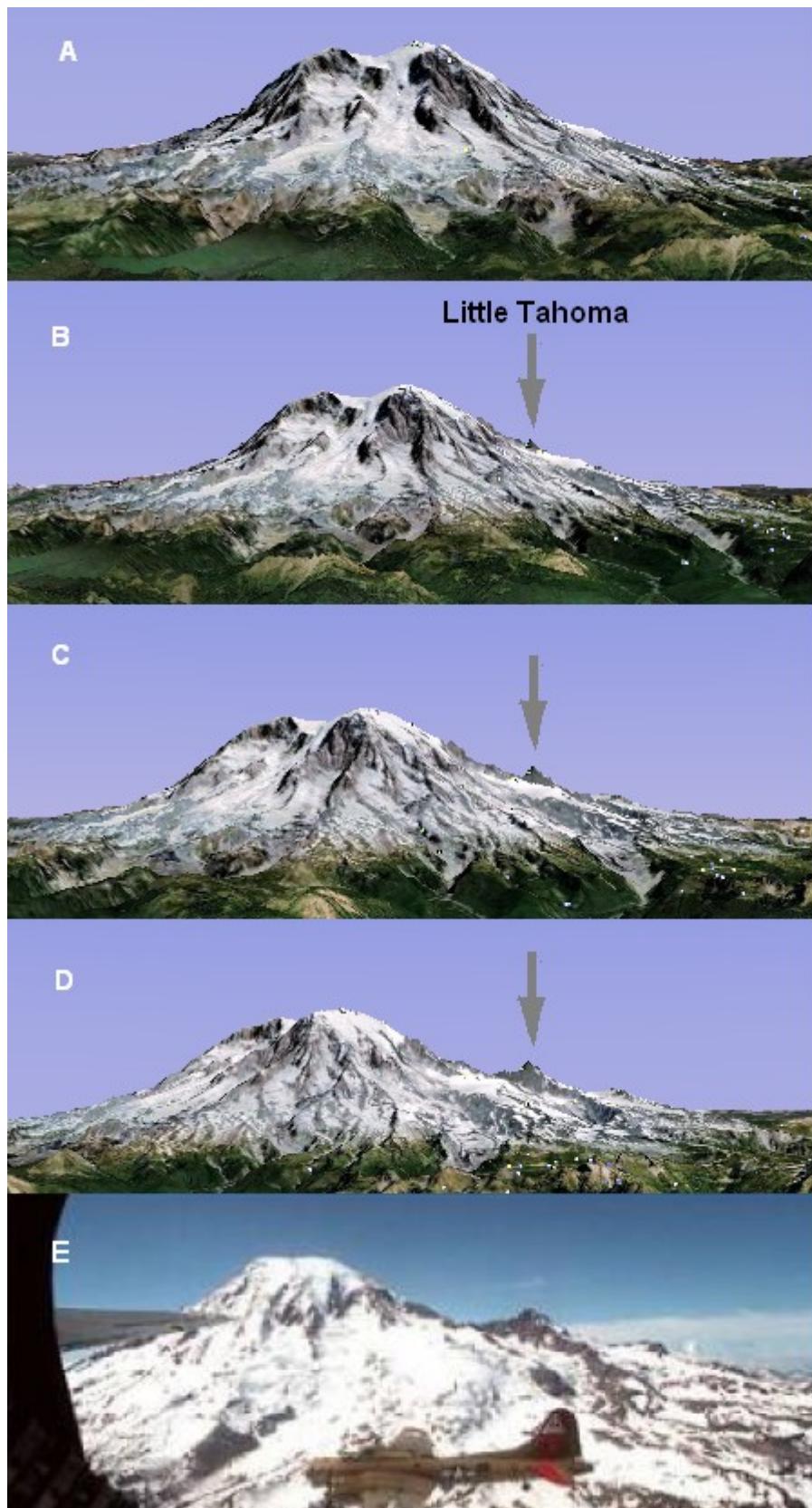


Fig.11. Sequence of Google Earth views from 9,200ft showing the emergence of the Little Tahoma sub-peak for an observer at different bearing angles south of Arnold's position

full-moon diameters above Arnold's far horizon in order to pass across the exposed tip of Little Tahoma, which conflicts with the description of an essentially level flightpath "on my horizon" and "hugging the mountaintops" near Mt Rainier, "swerving in and out of the peaks" whilst even climbing slightly to transit Mt Adams in the south

A serious secondary defect is that attempting to rescue Little Tahoma, by allowing Arnold to turn from Mineral onto a course far to the south of the course he reported, would immediately refute the explanatory hypothesis which this sub-hypothesis exist to serve, because we can prove geometrically that the former hypothesis is only compatible with a course turn to the north (see Section 10.iv.). The whole project is thus internally inconsistent.

The correct conclusion is that one should go back to the maps and seek a counterpart to the "jagged peak" referred to by Arnold, this time in some visible position on the SW side of the mountain and nearer the true horizon elevation, below 9,200ft. But rather than revisit the premises of Kottmeyer's argument, which might have allowed the discovery that Glacier Island fulfills the conditions of the report, Easton proceeded to seek reinforcement for his conclusion that Little Tahoma was "the only likely candidate" by consulting mountaineers in the region for their opinions as to the identity of an unidentified "jagged peak that juts out from the base of Mount Rainier proper". Several respondents predictably suggested Little Tahoma. One climber replied:

The jagged peak you are referring to is clearly Little Tahoma. It is jagged because it is unglaciated and very steep. It rises from the base of Mt. Rainier on the East or Southeast side. You said the observation was taken from the west or southwest. *This might be troubling because it is on the other side of the mountain*, but rest assured, Little Tahoma is the peak.[emphasis added]⁸³

And a National Park guide offered the consensus of his co-workers that the 'jagged peak' must be Little Tahoma, adding that it "can be seen from many areas around the mountain" - but apparently failing to mention that these areas do not include the area west of the mountain where Arnold was flying.

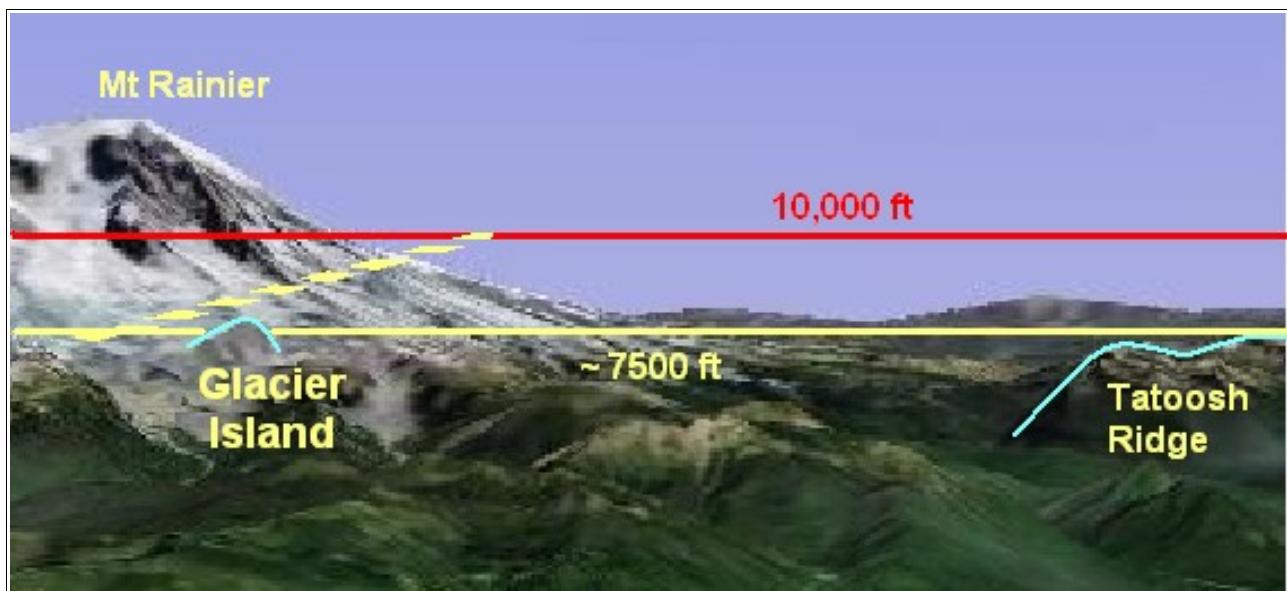


Fig.12 From 9,200 ft altitude near Mineral showing (illustratively) the 10,000ft level in relation to the Glacier Island cleft and Arnold's apparent horizon. The North end of the Tatoosh/Dixon ranges is indicated at right. Compare with Arnold's pencil sketch (Fig.4.)

83 Easton, J., Voyager Newsletter - Issue No. 10, UpDates mailing list April 08, 2000.

From these responses Easton concluded that "Little Tahoma (or Tacoma) was indeed the only peak which seemed to match Arnold's description" and (most mysteriously) that "it could have been visible from his location". The "repercussions are fundamental" he claimed, "a watershed". Kottmeyer's critical argument was now "established", along with the "obvious conclusion" that Arnold's observation was "unreliable", the result of some visual illusion that had deceived him into thinking that the objects went behind the peak..⁸⁴

In other words, because the objects "absolutely must have passed in front of" a peak which Arnold could not possibly even have seen (it being entirely on the far side of Mt Rainier from any point on or near Arnold's flight path), therefore Arnold's explicit report that they passed behind a *different* peak, which he *could* see, must be "unreliable" - this despite the fact that Easton's own map showed him Little Tahoma "on the mountain's far eastern side"⁸⁵ and despite the fact that his own informant had cautioned him that his proposal "might be be troubling because [Little Tahoma] is on the other side of the mountain".

In summary the argument in favour of Little Tahoma is inconsistent, unintelligible and topographically inaccurate, whereas Glacier Island (only a mile from the lower but more obvious Pyramid Peak which was Arnold's own best guess based on a crude topographic map in 1966) appears to answer all the requirements of the report. This falls short of a positive identification, but is a plausible best-fit.

84 *Ibid.*

85 *Ibid.*

7) The 5-mile plateau between Mt Rainier and Mt Adams

Arnold remarked: "never before had I seen planes flying so close to the mountain tops". As they flew south he described them "hugging the mountaintops" of the Cascade ridges *en route* towards Mt Adams. According to his 1947 Air Force report:

They seemed to hold a definite direction but rather swerved in and out of the high mountain peaks. . . . I observed the chain of these objects passing another high 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 assume that the chain of these saucer-like objects was at least five miles long. I could quite accurately determine their pathway due to the fact that there were several high peaks a little this side of them as well as higher peaks on the other side of their pathway.⁸⁶

In 1947 Arnold apparently did not identify this particular ridge in any public source. Neither did he do so in his 1952 book:

Between Mt Rainier and Mt Adams there is a very high plateau with quite definite north and south edges. Part of this chain-like formation travelled above this plateau towards Mt Adams, while part of the formation actually dipped below the near edge. . . . 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 neighborhood of five miles long.⁸⁷

The first findable identification of the ridge by name occurs not in Arnold's words but in a letter from James E. McDonald to Arnold in November 1966:

One of my colleagues, who is from Washington, reading some of the published accounts I have in my files also wondered if perhaps the peak behind which some of the objects disappeared might have been well south of Rainier, perhaps near Goat Rocks.⁸⁸

It is not clear from this if Arnold had previously volunteered the name of Goat Rocks or if the suggestion originated from the colleague (Prof. Richard Reed, U. of Washington, Seattle). Nine days later McDonald's notes of a telephone interview with Arnold record that on the first anniversary of the sighting, June 24 1948, Arnold "reflew Goat Ridge to check the calibration of the length (5 mi) of chain"⁸⁹ which appears to confirm Arnold's identification of the ridge.

Then in September 1967 McDonald wrote to a correspondent (believed to be Ted Bloecher) concerning a draft manuscript by the latter:

. . . you imply the objects passed behind 'Goat Rocks' (that is proper identification for them). I discussed that in some detail with Arnold and believe I have it correct that the peak was an outlier on the southwest flank of Mt. Rainier. Goat Rocks lie about half-way between Rainier and Mt. Adams.⁹⁰

86 Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/CUFOS files)

87 Arnold, K., and R. Palmer, *The Coming of the Saucers*, Amherst, Wisconsin, 1952, p.12

88 A complex of high ridges about 50 miles SSE of Mt Rainier later identified by Arnold (though not certainly; see Section 7) as the feature he used to scale the length of the chain of objects.

89 McDonald papers, University of Arizona; NICAP/CUFOS files, courtesy Mary Castner, CUFOS

90 McDonald, J.E., letter, probably to Ted Bloecher, 07 Sept 1967 (NICAP/CUFOS files, courtesy Mary Castner, CUFOS)

In Bloecher's document, published that same year (with an introduction by McDonald), we find the following:

He began to time them as the first object reappeared from behind the outlier peak on the southwest flank of Mount Rainier. (He later identified this peak as Goat Rocks, but he is probably in error as Goat Rocks is approximately half-way between Mount Rainier and Mount Adams.).⁹¹

This seems to be a misunderstanding both of Arnold and of McDonald. Bloecher is confusing the "jagged peak" on Mt Rainier (Section 6) with the distinct 5-mile ridge of peaks past which they subsequently flew *en route* to Mt Adams. Arnold was not in error here, neither was McDonald arguing that he had been. The Goat Rocks referred to by Arnold had nothing to do with this occultation episode but were a range of peaks miles south of Mt Rainier.

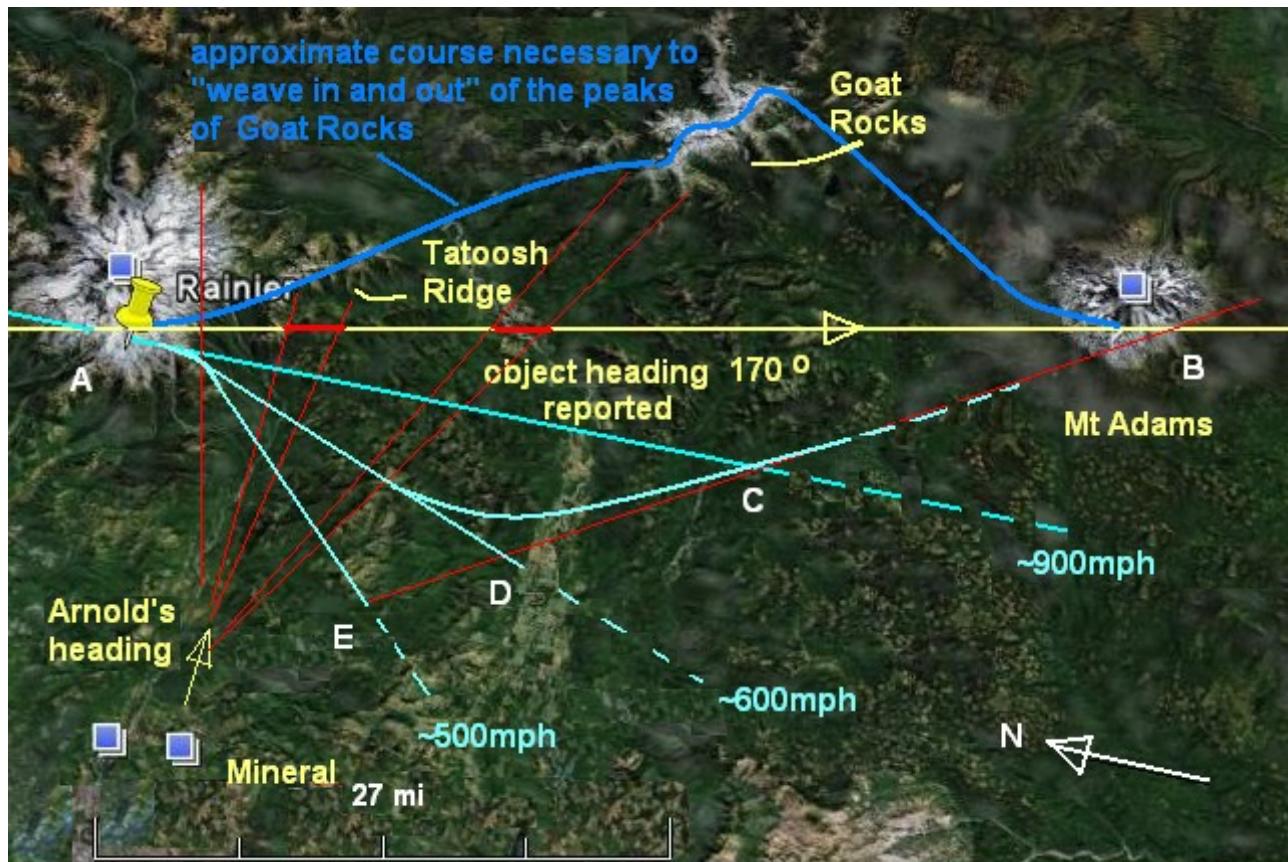


Fig.13 Location of Goat Rocks and Arnold's approximate lines of sight in relation to the reported object heading, AB (for discussion of other possible conjectural object headings of the types AC, AD & AE, see Section 10i., and Fig.17).

⁹¹ Bloecher, Ted, *Report on the UFO wave of 1947*, privately produced, 1967, p.24

But there could be another genuine confusion here originating with Arnold. McDonald continued:

. . . I have gone over my files and reviewed Arnold's own statements. You are right, he did say in one version that he saw the objects swerving among the peaks near the Goat Rocks.⁹² *But when I talked with him about that he was not so sure of it* [emphasis added].⁹³

This can be interpreted to mean that Arnold was unsure about the objects swerving among the peaks; but apparently he was not sure that the peaks in question were in fact Goat Rocks, only "fairly sure" that it had been a ridge "near" Goat Rocks. Some months earlier McDonald had written to a colleague:

[Arnold] says he is fairly sure (but *not positive*) that the hogback that he used to scale the length of the chain was *near* Goat Rocks; but said the objects passed on his side of that ridge (i.e., west of Goat Rocks) [emphases added].⁹⁴

The earliest findable identification of the ridge by name in Arnold's own words is dated 1977, when he actually uses the words "goat ridge". There is a Goat Ridge (among other "goat" names elsewhere in the Cascades) which is one minor feature of the complex of ridges known as Goat Rocks, but it does not answer Arnold's description of a 5-mile plateau with well defined north and south edges. Goat Rocks as a whole is a discrete high massif, but is far longer than 5 miles. If Arnold himself was not positive in 1966 that the 5-mile ridge was Goat Rocks, perhaps we should consider another possibility.

Consider Fig.13. From the various descriptions above one might expect to find Goat Rocks approximately along the apparent 170° flight path of the objects between Mt Rainier and Mt Adams. Clearly it is not. If they were heading towards Mt Adams then at the time when they were in line of sight with Goat Rocks at a distance from Arnold of about 20 miles, Goat Rocks itself would have been at least another 11 or 12 miles further beyond them. Arnold said that some of the objects flew above Goat Rocks whilst "part of the formation actually dipped below the near edge", and he scaled the formation by direct comparison with the length of the ridge in question, both facts implying that he *believed* the objects flew very close to or above the ridge. Indeed, he said:

I could quite accurately determine their pathway due to the fact that there were several high peaks a little this side of them as well as higher peaks on the other side of their pathway.⁹⁵

How is this compatible with Arnold's belief that the objects flew by on an approximate 170° heading 10 miles from Goat Rocks?

Remember that Arnold plotted this heading on the map as soon as he landed at Pendleton, and set about measuring the objects' speed along what he judged to be a *straight* path between Mt Rainier and Mt Adams (Section 2). This action is difficult to square with a belief that the objects had flown *via* Goat Rocks, whose large distance from the indicated heading would have been immediately

92 McDonald refers to Arnold's July 08 1947 Air Force letter where he says the objects "swerved in and out of the high mountain peaks". Actually this statement occurs in a general paragraph about the motion of the objects and could refer to Mt Rainier, as mentioned above. But later in that document Arnold does say that he could be sure of their path over this specific ridge (later identified by him as "goat ridge") because "there were several high peaks that were a little to this side of them as well as higher peaks on the other side of their pathway". Whether or not he meant in 1947 that they were actually *obscured* by the nearer peaks is a matter for debate.

93 McDonald, J.E., letter probably to Ted Bloecher, 07 Sept 1967 (NICAP/CUFOS files, courtesy Mary Castner, CUFOS)

94 McDonald, J. E., letter to Dr Richard J Reed, Department of Atmospheric Sciences, University of Washington, Seattle, Nov 29 1966 (McDonald papers, U. of Arizona; CUFOS)

95 Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/CUFOS files).

obvious on the map. Perhaps Goat Rocks was a suggested identification by some other party, and perhaps Arnold was at the time sufficiently unclear about the nomenclature in that part of the Cascades that he accepted it. Later, rechecking, he may have discovered that the topography did not fit - hence his disclaimer to McDonald that whilst he thought the ridge in question must have been "near" Goat Rocks he was "not positive" of it.

This uncertainty hinders our reconstruction of the later part of Arnold's flight path. And apart from *where* Arnold overflew his 5-mile ridge there is also the question of *when* he did so. Arnold said, "As I was flying in the direction of this particular [Goat] ridge, I measured it and found it to be approximately five miles"⁹⁶ and "I later flew over this plateau in my plane and came to a close approximation [of length]"⁹⁷ Now according to Arnold, after the sighting he also carried on looking for the crashed C-46 which was generally believed to have gone down on the SW side of the Mt Rainier plateau⁹⁸. He said he "continued [his] search for 15 or 20 mins" before deciding to head onwards to Yakima.⁹⁹ But it isn't clear whether this was before or after he flew the 5-mile ridge. Neither, indeed, is it clear *where* he made this "continued search".

One might readily assume that "continuing the search" means returning to the canyons of Mt Rainier. But Arnold did not say this, and actually the only search location he does mention is far away, which might explain why the scenario of a return to Mt Rainier leads to difficulties with identifying the 5-mile ridge as Goat Rocks.

Consider the relative locations shown in Fig.14. Arnold tells us that he was unable to concentrate on the search, being keen to land and tell somebody about what he had seen, and that for this reason he cut it short and flew to Yakima. If Arnold had decided to quit Mt Rainier because the crashed plane and the \$5000 reward seemed less important than hurrying to Yakima, what was he then doing diverting 30° and at least 15 miles south of his Yakima heading in order to fly the ridges of Goat Rocks? This purposeful diversion would also seem inconsistent with his explanation that he happened to be "flying in the direction of this particular ridge".

An alternative scenario is suggested by the fact that the balance of evidence strongly indicates that Arnold was heading SE at the end of the sighting after clocking the objects' speed (see Section 10.iv.b for detailed discussion). In this case he could well have been flying "in the direction of" Goat Rocks, and could have taken the opportunity to measure the ridge *before* flying back to Mt Rainier. But even then, assuming only the briefest possible visit to Mt Rainier, the shortest straight-line route from Mineral to Goat Rocks to Mt Rainier and then to Yakima is more than 130 miles, and realistically could easily be 150 miles without even allowing for distance consumed in the search of Mt Rainier itself. Yet he landed in Yakima at 4.00pm after a total elapsed time of about 1 hour. This would be just possible *if* his plane had a top speed of 150mph (unlikely; his CallAir appears to have been the 125hp model with a max speed of 120mph, see Section 3)¹⁰⁰ and *if* he had flown at maximum throttle all the way; but such fuel-thirsty flying¹⁰¹ seems highly unlikely, if not beyond the capacity of the CallAir's little 30 gal tank. So this flightpath also appears to be ruled out.

96 Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/CUFOS files)

97 Arnold, K., and R. Palmer, *The Coming of the Saucers*, Amherst, Wisconsin, 1952, p.12

98 As indeed it had. Arnold's 1950 pamphlet *The Flying Saucer As I Saw It* pictures the site of the wreckage discovered in late July 1947 at 9,500ft on the 'Tacoma Glacier', which is an error. The plane crashed on the South Tahoma Glacier, see: http://www.historylink.org/index.cfm?DisplayPage=output.cfm&file_id=7820. (It is an easy mistake to make, occurring once, in 17 references, even in the 146 definitive pages of: Reese, G.F., *Mount Rainier National Park Place Names*, <http://govdocs.evergreen.edu/pdf/nationalparkservice/place-names-rainier.pdf>)

99 Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/CUFOS files)

100 The effect of winds approximately cancels out over the two extra flight legs from Goat to Rainier to Tieton.

101 The most economical fuel consumption at 60% power would be only approximately 15 miles per gallon. See Section 3. 100% power is in practice only ever used in take-off or for rapid climbs. Normal cruise is nominally 75%

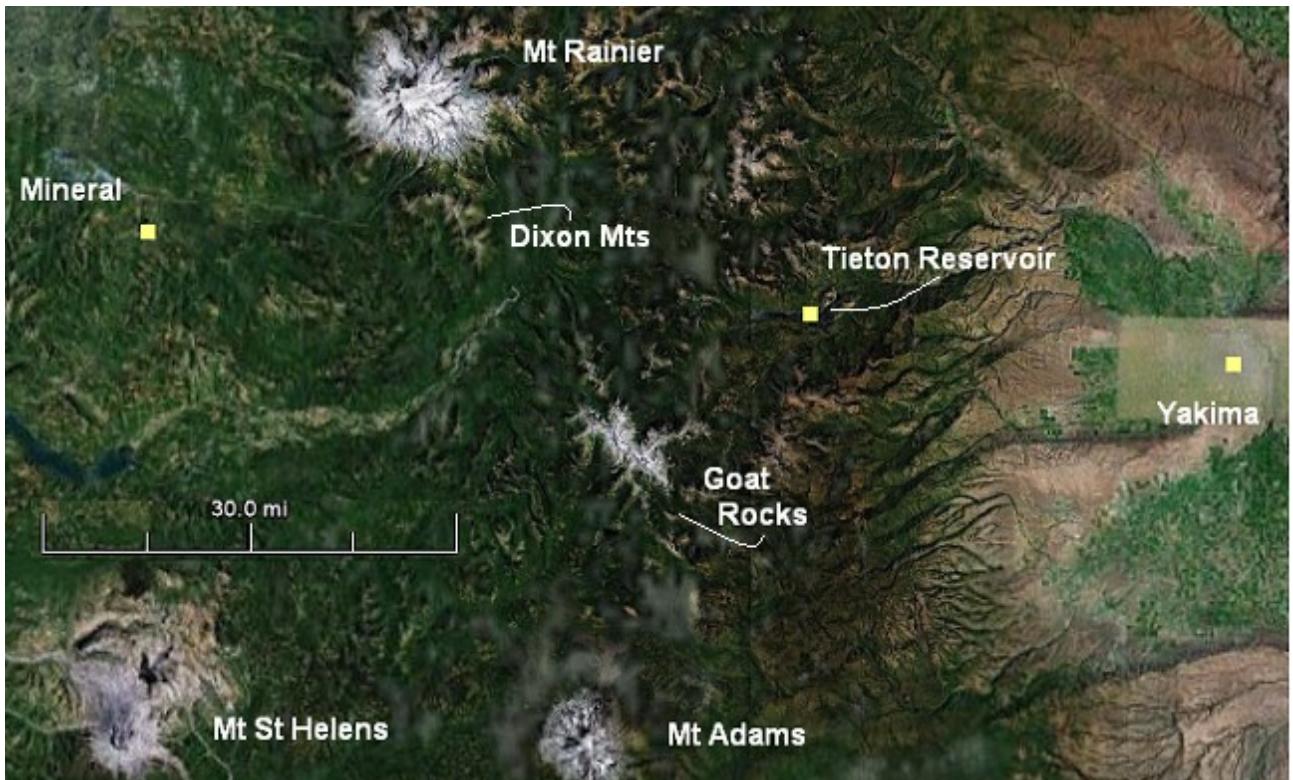
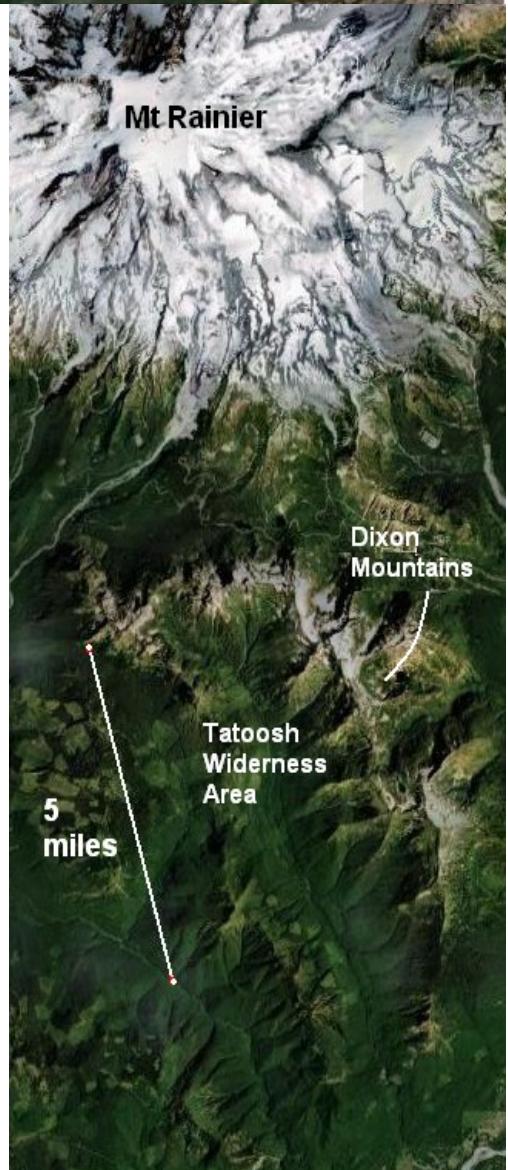


Fig 14 (above). After the sighting Arnold flew over the 5-mile ridge and resumed his search for the missing C-46 before heading to Yakima, arriving one hour after the sighting at 4:00pm. Constraints on distance, time and logic tend to indicate that if the 5-mile ridge was Goat Rocks then Arnold flew there directly at the end of the sighting, and from there to Tieton, and that these visits were part of what he referred to as his "continued search" for the C-46

Fig 15 (right). Could the Dixon range be the "real" 5-mile ridge? The Tatoosh area lay directly ahead of Arnold when he turned above Mineral and trimmed his plane for Yakima. The objects following Arnold's estimated $\sim 170^\circ$ course past Mt Rainier would have flown more or less straight across the Tatoosh area, possibly down the line of the Dixon Mts ridge. Compare Arnold's drawing of the skyline in Fig.4. This is of course highly schematic; nevertheless the ridge with a "well-defined" northern edge shown south of Mt Rainier does bring to mind the abrupt northern rampart of Tatoosh (e.g., Fig.12). One question is whether the Dixon range, which is somewhat lower than Goat Rocks at generally 5-6000ft and not glaciated, would have been snow-capped in late June 1947. It is no doubt less likely, but perhaps not impossible (see Note 75).



Another scenario has Arnold initially returning to Mt Rainier then checking out the Tieton Reservoir area before doubling back SW to Goat Rocks and finally from there to Yakima. This would be a shorter total distance, but seems psychologically implausible. It would be inconsistent with his stated eagerness to get to Yakima "after taking a last look at Tieton Reservoir".¹⁰² Again, he would obviously not have been "flying in the direction of this particular [Goat] ridge" when leaving Tieton for Yakima.

So the assumption that Arnold returned to search Mt Rainier, and the identification of the 5-mile ridge as Goat Rocks, raise problems for one another. There seem to be two possible hypotheses that might reconcile things: *a*) that the continuation of Arnold's search (such as it was) was not conducted over Mt Rainier; or *b*) that the 5-mile ridge was not Goat Rocks. We consider these in turn.

a) It is very possible that when Arnold spoke of this "continued search" he did not mean that he returned to the SW canyons of Mt Rainier. In his most detailed 1947 account he does not mention returning to Mt Rainier. In fact the only search location he gives is the Tieton Reservoir, over 30 miles away. So it may be that he was speaking of a search over other areas of the Cascades southeast of Mt Rainier, near his route to Yakima. It is true that the C-46 was generally believed to have gone down near Mt Rainier (as in fact it had), but clearly after almost six months of fruitless searching this was no longer considered definite, certainly not by Arnold if he took the trouble to search Tieton Reservoir 30 miles away.

Later accounts by Arnold do tend to be consistent with this interpretation. In 1952 he does not specify returning to Mt Rainier: "I tried to focus my mind on a continued search . . . but somehow the \$5000 didn't seem important. I wanted to get on to Yakima and tell some of the boys what I had seen."¹⁰³ Indeed this account does not clearly imply any return to a proper search at all.

In his 1977 account Arnold once again does not mention returning to Mt Rainier to search for the missing plane, and implies that when the objects disappeared "I sort of lost interest in my search mission and I decided that maybe I ought to go to Yakima and report it . . . *I just kept flying on* the way they had traveled across the Cascade range and on to Yakima." [emphasis added].¹⁰⁴

Clearly the "15 or 20 minutes" of "search" after the sighting mentioned in Arnold's early report has to be taken seriously, but the several accounts can be resolved if this was a reference to taking time to look for the plane during his flight over the Cascades south of Mt Rainier, including a pass over the 5-mile ridge and the check of Tieton Reservoir, all broadly *en route* to Yakima. This would make sense of the statement "*I just kept flying on* the way they had traveled", would imply a generally SE course at the end of the sighting consistent with his probable heading during the clocking of the southbound objects (see Section 10.iv), and would be consistent with the statement "*I was flying in the direction of this particular [5-mile] ridge*".¹⁰⁵

b) Alternatively one can try out the scenario that Arnold did resume a search on Mt Rainier but that the 5-mile plateau was another ridge much nearer Mt Rainier than Goat Rocks, perhaps the Dixon Mountains forming the high eastern ridge of the Tatoosh Wilderness upland area (see Fig.13) rising sharply a few miles south of Mt Rainier and extending about 5 miles SSE in a long ridge rising to around 6000ft (Fig.15). It is certainly true that this ridge fits remarkably well the sketch by

102 Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/CUFOS files)

103 Arnold, K., and R. Palmer, *The Coming of the Saucers*, Amherst, Wisconsin, 1952, p.12

104 Arnold, K., "How It All Began" in Fuller, Curtis G., *Proceedings of the First International UFO Congress* [1977], Warner, 1980, pp. 17-29

105 Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/CUFOS files)

Arnold shown in Fig.4, Sect.4 (see also Figs.10a and 12, Sect.6) although this is clearly very schematic. After flying Tatoosh/Dixon to measure it Arnold could have returned directly to Mt Rainier then headed *via* Tieton to Yakima in a little less than 100 miles, or about 1 hour at the cruise speed of the CallAir, enabling Arnold to arrive at Yakima by 4:00pm.

But there is still minimal time for any real search of the Mt Rainier canyons - certainly not 15-20 minutes - so we find ourselves back with some form of the hypothesis that when Arnold said he "continued [his] search for 15 or 20 minutes" he meant to include at least some time spent searching areas other than the Mt Rainier canyons. So this alternative scenario is not very clearly separated from scenario *a*) which already seems reasonably consistent. Moreover, scenario *b*) suffers from the additional criticisms that the non-glaciated Tatoosh in June, at 5-6000ft, does not quite so comfortably fit the description of a "high snow-covered ridge" (although this is not impossible given likely upward recession of June snowlines since 1947; see Note #75) and that even if Arnold was "not positive" of the identification of Goat Rocks he was at least "fairly sure" that it was "near" Goat Rocks. Tatoosh is not really near Goat Rocks.

In summary there may be some room for doubt that the 5-mile ridge was Goat Rocks, although there is insufficient evidence to conclude that it was the Dixon Mountains bordering the Tatoosh wilderness area. In fact it isn't clear that scenario *a*) and scenario *b*) are necessarily mutually exclusive for our purposes. Arnold's testimony tells us explicitly that his continuation of the search for the C-46 was at least in part conducted far from Mt Rainier, and whether the 5-mile ridge was (near to) Goat Rocks or the Dixon range, it would in either case be consistent with the testimony *if* Arnold's continued search did not involve a return to the canyons of Mt Rainier at all. This will prove a significant conclusion in relation to the analysis of Arnold's heading in Section 10.iv.

8) Arnold's judgments of the objects' angular and physical size

In 1947 Arnold reported that he had observed the shapes of the objects "quite plainly" in near-ideal conditions. He estimated visibility to be such that it was "very easy" to make out objects identifiably at 50 miles in air of "exceptional clarity" and "clear as crystal".¹⁰⁶ The afternoon sun was high behind Arnold's right shoulder,¹⁰⁷ obviating eye glare whilst illuminating the oscillating objects at an optimum angle (apparently producing specular reflection highlights on the top sides), whilst the snowy mountain backdrop fortuitously provided conditions for a high-contrast silhouette which Arnold said was "black" and seen "quite plainly".

But much debate has since focused on the question of just how plainly objects of the the estimated size at the indicated distance *could* have been observed given the small-angle limitations on human visual acuity. The prototype of this oft-repeated objection was astronomer J. Allen Hynek's evaluation for the USAF in 1948 which provided the excuse for Project Grudge to dismiss the report as incoherent: "The entire report of this incident is replete with inconsistencies . . . The report cannot bear even superficial examination, therefore, must be disregarded."¹⁰⁸

Actually it was Hynek's analysis that was incoherent. Hynek argued that Arnold's estimates of size and distance together indicated an angular width of only about 80 arcsec, too small for shape to be resolved. Indeed Hynek's argument implied that such objects could not have been seen at all. To correct Arnold's impressions, Hynek started from the assertion that the human eye is known to be unable to detect a line thinner than 3 arcmin (180 arcsec) and therefore reasoned that the objects must have had a minimum angular thickness of 3 arcmin in order to have been seen. Arnold had reported that the objects were just visible edge-on with an apparent thickness about 1/20 of their length. From these premises Hynek proceeded to conclude that each of the objects would have to have been at least 100ft thick and an "unreasonable" 2000ft long.

Hynek ought to have been alerted immediately to the absurdity of a calculation which implied that in order to be visually detected at all each of the objects would need to be about 1° wide, or twice the diameter of the full moon, and should have checked his own argument for sources of error. Had he done so he might have realised that his resolution limit of 3 arcmin was based on a gross misunderstanding of the nature of visual acuity. The 3 arcmin figure is a standard used in Snellen eye test charts and represents the ability of the eye to discriminate a group of closely-spaced lines in order to identify a test letter, say an 'E'. This type of *resolution acuity* is not directly related to the measure of the eye's ability to discern thin lines, or *detection acuity*, which is the measure Hynek ought to have applied when arguing from a minimum detectable angular thickness.

The limit of detection acuity (in optimal conditions) is generally regarded as approximately 0.5 arcsec,¹⁰⁹ fully 360 times smaller than the 3 arcmin assumed by Hynek (at 20 miles distance this angle corresponds to a mere 3 inches or 7.6cm!). Indeed, although the Blue Book files contain no surviving reference to any angular size considerations except those by Hynek which were appended to the Final Report of Project Grudge, according to Ruppelt¹¹⁰ sceptical ATIC analysts at the time actually made the same argument on the basis of a minimum detectable angular thickness of less than half the standard value - only 0.2 arcsec¹¹¹. Thus it appears that, starting from mutually

¹⁰⁶ Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/CUFOS files). See also weather data in Appendix 2.

¹⁰⁷ Az. 232° 37', alt. 57° 48'

¹⁰⁸ Final Report of Project Grudge, April 27, 1949. ATIC files.

¹⁰⁹ http://en.wikipedia.org/wiki/Visual_acuity

¹¹⁰ Ruppelt, Capt. E.J., *The Report on Unidentified Flying Objects*, Ace Books, NY 1956 p.28

¹¹¹ Nothing sensible can be inferred from calculations in this extreme limit. 0.2 arcsec corresponds to a wafer-thin 1.5 inches or less (3 or 4 cm) even at the estimated distance, and applying the 20:1 aspect ratio reported by Arnold would

exclusive premises differing by a factor of fully 900, both Hynek and ATIC managed to reach the same conclusion: That unless the objects were much closer and much slower than Arnold thought he could not even have seen them.

That this risible exercise has gained wide approval as a supposed proof that Arnold's description cannot be reliable is bad enough. But even in an optically consistent form this type of argument would be a *non sequitur* which amounts to no more than the truism that if the objects were too small to have been seen then Arnold wouldn't have seen them. The ignored corollary, invoking a correct argument from resolution acuity, is that if he could in fact see them, and discern their distinctive shapes "plainly", they must have been as large as they needed to be in order to subtend something in excess of about 3 arcmin of visual angle. And it is noteworthy that this conclusion is consistent with an angular calibration made by Arnold in real-time during the sighting using a known target, a DC-4 airliner simultaneously visible to the north.

The trigonometrical relationship was properly understood by Arnold. He'd offered the newspapers a guess as to the absolute size of the objects, but in his detailed report to the Army Air Force he contented himself with the remark, "I knew they had to be very large to observe their shape at that distance"¹¹² and gave only an *angular* equivalent measure. However, it was not understood by the AAF's Air Technical Intelligence specialists. First they misinterpreted Arnold's measurement of relative angular size as an estimate of absolute size; next they introduced a simple numerical error into this fabricated absolute size estimate; and finally they sought to apply this erroneous absolute size figure as though it was a constraint on the trigonometry instead of being one of the unknowns we need to solve for. It is little short of incredible that a supposedly scientific analysis can have proceeded on this basis (as Arnold remarked of his sighting, "It seems impossible, but there it is"¹¹³).

Arnold reported that he measured the angular size of the objects in real time using a physical measuring stick in the form of a Dzus cowling tool that happened to be in his pocket. This object was a sort of small screwdriver or grip for the 1/4-turn spring fasteners used on engine cowling maintenance panels.¹¹⁴ Using this gauge Arnold was able to judge that the angular length of the objects was approximately equal to the span of the outer engines of the 4-engine DC-4 airliner which was simultaneously visible behind his left wing at an estimated 15 miles distance.

Arnold's action is a reality-check on abstract arguments purporting to prove that Arnold could not have seen resolvable shapes: To make a comparison such as he described, one obviously first offers the tool up to the DC-4 and uses some feature on the tool and/or maybe a thumbnail to "mark" an angular size (he didn't specify the marker) and then transfers the tool onto one of the unidentified objects to "read off" its comparative angular size. Such a procedure makes concrete the facts a) that Arnold was able to resolve and physically measure the wingspan and/or engines on the DC-4, and b) that he was able to resolve a similarly measurable angular extension on the unknown objects.

Unfortunately the ATIC Incident #17 case file obscures all such issues by reducing the incident to the following inaccurate summary:

make the objects no more than 4 arcsec long, which whilst theoretically perceptible is about 50 times too small for any shape whatsoever to be resolved. Of course even the 0.5 arcsec angular thickness limit would apply normally to an extended black line on a perfectly even white ground in test conditions; a 0.5 arcsec splinter against a mountain snowfield would be an unrealistic visual target in real-world conditions, even given superb atmospheric clarity and fine eyesight. But since such an image would still be 20 times smaller than anything that could possibly correspond to the shapes that Arnold "observed quite plainly" the matter is academic.

112 Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/CUFOS files)

113 Associated Press wire story filed by Bill Bequette, Pendleton, Ore., *East Oregonian*, June 25 1947

114 <http://www.speedtv.com/forums/viewthread/475504/> or

<http://www.aircraftspruce.com/catalog/hapages/dzusfastener-tools.php>

Pilot Kenneth Arnold was flying his plane at an altitude of approximately 9,200 feet. He trimmed out plane in direction of Yakima, Washington, whlch was almost directly east of his position and sat in his plane observing the sky and the terrain. To the left was a DC-4 and to his rear approximately 15 miles distant there was a 14,000 ft elevation.¹¹⁵ The sky was clear as crystal. A bright flash suddenly reflected on the plane. Upon looking to the left and to the north of Mt Ranier he observed a chain of 9 peculiar looking craft flying from north to south at approximately 9,500 ft elevation and going seemingly in a definite direction of about 170°. Thought at first they were jet aircraft but noticed that every few seconds 2 or 3 of them would dip or change their course slightly just enough to cause the sun to strike them at an angle which reflected brightly on his plane. As they approached Mt. Rainier he could observe their outlines against the snow quite plainly, but couldn't find any tails. Clocked speed and found it to be approximately 150 MPH.¹¹⁶ Never before had he observed planes flying so close to mountain tops. They flew directly south to southeast down the hog's back of a mountain range. Pilot thought they were at approximately the same elevation as he was. They flew in rather diagonal chain-like line as if linked together and seemed to hold a definite direction but swerved in and out of the high mountain peaks. Distance which was almost at right angles seemed to be between 20 to 25 miles. Thought they were quite large to be observed at that distance even on a clear day.¹¹⁷ They seemed smaller than the DC-4 but he judged their span to be as wide as the furtherest engines on each side of the fuselage of the DC-4 (45 to 50 ft.).

This document appears to be the origin of the "45 to 50ft" figure.¹¹⁸ It is not given here as an estimate of the absolute size of the objects (as it would be later), but as a measure of the outer engine span of a DC-4, which span Arnold had used as an *angular* comparison. In fact this span is almost 60ft, so the figure is inaccurate as well as being misapplied. But later this poor summary was evidently used, by ATIC staff who should have known better, as the source for the Incident #17 Check List,¹¹⁹ in which (see Fig.16) "45 to 50ft" explicitly becomes the absolute size of the objects, with the error in engine-span measure compounded by now being defined as "size of DC-4"¹²⁰ and it is in this form that the figure has been handed down through UFO history.

Here is what Arnold actually did report.

According to a handwritten annotation by Arnold on his original typed report the DC-4 visible just behind his left wing was "travelling north along the airline route",¹²¹ which route he later identified

115 This is garbled. There was no "14,000ft elevation" (mountain) "to his rear" (west). Rather, a DC-4 to the north, behind his left wing, was estimated to be at 14,000ft.

116 Again this is garbled. Arnold clocked the objects' speed at about 1700mph. Where "approximately 150mph" comes from is a mystery but could be a misunderstanding based on the CallAir's maximum speed of about 150mph.

117 Arnold had actually told the Air Force "I knew they must be *very* large to observe their shape even on as clear a day as it was that Tuesday [emphasis added]."

118 Nothing is to be found in the official files or the public literature. Inquiries to individual researchers and to the historical research mailing list Project 1947 failed to turn up a reference to any earlier source.

119 The Check List also inherits from the same summary the erroneous object speed of "approx. 150 MPH"

120 The DC-4's span and length are in fact about 117ft and 94ft respectively

121 Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/UFOS files)

as the "San Francisco to Seattle run".¹²² Thus its bearing was near north from Arnold and it was heading north, meaning that its wings would have been aligned near perpendicular to the line of sight with minimal foreshortening. The outer engine span of a Douglas DC-4 is approximately 60ft which at the range estimated by Arnold, about 15 miles, would equate to an angular width of about 2.6 arcmin. But for Arnold to be able to comfortably identify the DC-4 and resolve its engines we would prefer that these subtended a minimum visual angle of at least 3 arcmin. This in turn would mean that the plane was somewhat closer than Arnold's estimate of 15 miles, probably no more than 12 - 13 miles, which is fine. Even for an experienced aircraft observer, in the absence of distance cues a roughly 15% error in judging range is a perfectly acceptable performance.¹²³

13.	Direction of flight	North to South at 170°
14.	Tactics	Horizontal flight
15.	Sound	N/S
16.	Size	Approximately that of DC-4 - 45 to 50 ft
17.	Color	mirror like
18.	Shape	Approximately circular

Fig.16. Detail from the Incident #17 Check List in the ATIC file.

Arnold believed his range from the unknown objects was about 23 miles, at which distance an object subtending an angle of 3 arcmin would be about 100ft long. This is consistent with Arnold's own June 1947 estimate. According to the very earliest sources he was, by implication, guessing a figure of about 100ft and he later made this explicit.

On June 26 1947 he was quoted as describing "shiny flat objects each as big as a DC-4,"¹²⁴ and on June 27 they were "big as DC-4 airplanes, shining like mirrors, and weaving like the tail of a kite"¹²⁵ As mentioned above, both dimensions of a DC-4 are ~100ft. In a broadcast interview in April 1950 Arnold said they were "at least 100 feet across".¹²⁶ What appear to be typed notes of an interview with Arnold, initialled by University of Washington meteorologist Dr. Richard J. Reed and dated March 1965, record Arnold as saying that the objects seen at Mt Rainier were "100 ft".¹²⁷ And twelve years later he was still saying the same thing, telling his 1977 Fate symposium audience: "I judged their size to be, probably, a hundred feet."¹²⁸

But once the meme "45 to 50ft" had found its way into the file *via* the anonymous case summary and Incident Check List it reproduced and spread. It was ratified by Hynek's use of it in his evaluation, which was printed as an appendix to the final report of Project Grudge in 1949. It was then quoted by others with access to the file and/or to the findings of Grudge.

122 Arnold, K., and R. Palmer, *The Coming of the Saucers*, Amherst, Wisconsin, 1952, p.10.

123 In one place, indeed, Arnold wrote "10 to 15miles", reducing his mean error to zero (source mislaid).

124 AP; Pendleton, Oregon, *East Oregonian*, and various papers June 26 1947

125 *Chicago Times*, June 27 1947

126 Interview with radio journalist Ed Murrow, broadcast Apr 7 1950.

127 Typed notes dated March 11 1965, initialled 'RJR/dm'. R.J.Reed had written about the Arnold sighting in *Weatherwise* in 1958 and corresponded with McDonald during 1966. His notes are in a NICAP file of the papers and correspondence of Dr. J.E.McDonald (courtesy Mary Castner/CUFOS).

128 Arnold, K., "How It All Began" in Fuller, Curtis G., *Proceedings of the First International UFO Congress* [1977], Warner, 1980, pp. 17-29

In 1953 the influential first book by astronomer Donald Menzel cited the "45 to 50ft" figure (like Hynek he was an ATIC consultant and insider, and page proofs of his treatment of the Arnold case appear in the Air Force file).¹²⁹ Project Blue Book chief Capt E. J. Ruppelt cited the same claim in an influential magazine article in 1954,¹³⁰ and his famous book re-echoed it two years later.¹³¹ The meme has since replicated itself far and wide *via* these presumptively authoritative sources along with the prejudicial canard that Arnold's judgment had been revealed as being (in the words of the Grudge evaluation) "replete with inconsistencies".

In 1981, three years before his death, Kenneth Arnold himself remarked on Hynek's error in a little-known complaint made to interviewer Greg Long. He was still angry, he said, that Hynek had relied on an inaccurate account and so accused him of reporting "inconsistencies of size and distance" back in 1949. Arnold had later challenged Hynek and asked him why, instead of consulting the original text, he had been satisfied with an Air Force summary. Hynek replied, "Well, I was working for the Air Force."¹³²

The quality and consistency of scientific commentary on this aspect of Arnold's report has been lamentable. In contrast, Arnold's interlocked visual judgments of distance, angular width and physical size appear to be quite consistent and we conclude that his report of observing the objects' shapes is plausible. Of course for a given angular size we can plug different pairs of values into the calculation to satisfy the same conclusion. As discussed in Sections 3 & 6, Arnold's minimum distance from a chain of objects on a ~170° trajectory passing between the flank of Mt Rainier and the outlying Glacier Island (about 3 miles from the summit) could have been as little as 16 miles (26km). Referring to points E and F on Fig.3, and to the arguments in Sections 3 & 6, it seems the distance at the time Arnold made his measurement was almost certainly in the range 16-20 miles, leading to brackets on a minimum absolute length, consistent with all factors, of about 70 - 90ft.

129 Menzel, D.H., *Flying Saucers*, Harvard University Press, Cambridge, Mass., 1953 (galley proofs in ATIC file p47)

130 Ruppelt, E. J., 'What Our Air Force Found Out About Flying Saucers' *True*, 18-30 (May, 1954) pp.124-134

131 Ruppelt, Capt. E.J., *The Report on Unidentified Flying Objects*, Ace Books, NY 1956 p.28

132 Long., Gregory, 'Kenneth Arnold: UFO Pioneer', *MUFON Journal*, (ed. Richard Hall) Seguin, Texas. #165, Nov. 1981 p.7; cited in: Gross, L., 'UFOs: A History - Vol.1 1947', Fremont, Ca., 1988 p.11

9) Arnold's judgment of the objects' true course and speed

Probably the single most dependable number we have in this case is a duration. It is a deliberate "instrument observation". The transit of the objects over the angular distance between Mt Rainier and Mt Adams was measured by Arnold on his cockpit clock in real time for the express purpose of estimating their speed. The duration was approximately 102 seconds. As we heard in Section 2, when Arnold landed at Pendleton and the true distance between these landmarks was measured from a map his impression of "incredible" speed was apparently confirmed. It came out at around 1700mph.

Arnold was evidently well aware of the approximations involved in translating his clock measurement to a speed. In the earliest public statements he volunteered comments on possible sources of error, cautioning in a radio interview on June 26 that

when I observed the tail end of the last one passing Mt. Adams . . . I was at an angle near Mt. Rainier from it¹³³

meaning that the true geographical position of the objects relative to Mt Adams was much less easy to estimate than initial position relative to nearby Mt Rainier had been.¹³⁴ This was the same caveat he repeated in later accounts:

And I just thought, oh, it's a beautiful day and I've got a beautiful viewpoint here and I'm going to clock their speed even though I was closer to Mt. Rainier than to Mt. Adams, which was directly to the south and in their line of flight. ¹³⁵

He was able to unambiguously clock the moment at which the lead object "jetted south" from the edge of Mt Rainier as seen from his position WSW of the mountain. But he realised that his true range from the objects was some unknown distance less than the distance to the summit of Mt Rainier, and because he would be viewing the dwindling objects near Mt Adams at such a narrow angle to their course he was in no position to mark the moment of an equivalent alignment against the south face of Mt Adams. He knew that there was uncertainty because he could only guess the point at which the lead object would be passing abreast of Mt Adams at the same WSW compass bearing from an equivalent point on that mountain's south face. Arnold clearly understood that the effect of allowing for this perspective asymmetry would introduce a rightward shift in the line of sight to this equivalent point. Thus from his point of view the object would appear to have *passed* Mt Adams by some angular distance when, from its own point of view, it was abreast of the equivalent point.

The elements of the intuitive judgement he made were evidently these: He assumed that the chain of objects was a few miles long;¹³⁶ that it passed a few miles west of the summit of Mt Rainier;¹³⁷ and that it passed Mt Adams at a similar sort of distance. Thus Arnold judged that when the *last* member of the chain (seen now in a narrowing perspective and rotated considerably away from its original transverse orientation) was aligned with the right-hand edge of Mt Adams, the first member of the chain would by then have passed Mt Adams and would be roughly aligned on a WSW bearing from the south face of the mountain.

133 Broadcast interview of Kenneth Arnold by journalist Ted Smith, KWRC radio, Pendleton, on June 26, 1947

134 Of course, the sign of the possible resulting error is also unknown and could in principle tend to increase the calculated speed as well as reduce it; but see Section 10.i.

135 Arnold, K., "How It All Began" in Fuller, Curtis G., *Proceedings of the First International UFO Congress* [1977], Warner, 1980, pp. 17-29

136 An estimate later confirmed for him by measuring "Goat Ridge" at about 5 miles. See Section 7.

137 Later confirmed from topographical investigation as about 3 miles. See Section 6.

He was very positive about this. Thus, on June 26 he described how he started to clock the first "plane" when it "came to the south edge of Mt Rainier" and finished the timing as he "observed the tail end of the last one passing Mt. Adams".¹³⁸

On about July 4 he wrote up his account for the Army Air Force:

I remember distinctly that my sweep second hand on my eight day clock, which is situated on my instrument panel, read one minute to 3 P.M. as the first object of this formation passed the southern edge of Mount Rainier . . . As the last unit of this formation passed the southernmost high snow-covered crest of Mt Adams, I looked at my sweep second hand and it showed that they had travelled the distance in one minute and forty-two seconds.¹³⁹

And in his later book:

I recall that when the first craft of this formation jetted southward from the snow-based cleft of Mt Rainier my second hand was approaching the top of my hour dial and the time was within a few seconds to one minute of three . . . As the last of this group of objects sped past and seemed to gather altitude at a point beyond the southernmost crest of Mt Adams, I glanced at the sweep second hand of my instrument clock.

And in a talk given in 1977 he recalled that he started to clock them "as the first one [was] putting its nose out of the southern edge of the snowfield of Mt. Rainier" and checked his clock again "to be quite sure, as the last of this echelon formation of these strange aircraft actually passed Mount Adams".¹⁴⁰ And here Arnold makes his motivation explicit: "To be quite sure."

In this way Arnold made an attempt to correct for the asymmetrical perspective by delaying his second timing mark, and in doing so would have *minimised* the angular rate. All considered this method was probably based on a fairly accurate intuition of the geometry and was properly conservative.

In addition Arnold was conscious of the uncertainty introduced by his own relative motion:

I was going to clock their speed with my 24 hour clock which has a big sweep second hand on my instrument panel. . . . I was approaching Mt. Rainier. I realized that my attempt to clock their speed absolutely accurately would have been hopeless because I was rapidly approaching Mt. Rainier at 9200 ft at about a hundred miles an hour . . .¹⁴¹

He also recognised that reading elapsed time off a clock in these circumstances "cannot be entirely accurate" because in taking his eyes off the objects to look at the clock he could have made an error of "several seconds".¹⁴²

Arnold's approach to approximation was the sound one of absorbing sources of possible error into grossly over-conservative estimates, pointing out that even doubling the measured time (or equivalently halving the apparent distance flown) would still result in a speed some 200mph faster than the 1947 airspeed record.¹⁴³ By making more realistic but still very conservative assumptions

138 Broadcast interview of Kenneth Arnold by journalist Ted Smith, KWRC radio, Pendleton, on June 26, 1947

139 Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/CUFOS files)

140 Arnold, K., "How It All Began" in Fuller, Curtis G., *Proceedings of the First International UFO Congress* [1977], Warner, 1980, pp. 17-29

141 *Ibid.*

142 Arnold, K., and R. Palmer, *The Coming of the Saucers*, Amherst, Wisconsin, 1952, p.10.

143 Broadcast interview of Kenneth Arnold by journalist Ted Smith, KWRC radio, Pendleton, on June 26, 1947

he got the figure lower than the initial 1700mph. But it was still over 1350mph, more than twice the speed of the fastest jet fighter, and Arnold admitted that even this was "so far on the conservative side that I knew it was incorrect."¹⁴⁴ Talking in public two days after the event he downplayed this still further, saying that the "best" he could do by making the most generous "allowance for error" would be about 1200mph.¹⁴⁵

It was the extraordinary speed of the objects more than anything that impressed and mystified - as well as embarrassed - Arnold. Along with the erratic "flipping" and undulating flight it was this that convinced him he had seen some new type of remote-controlled rocket technology, either of the US Army or of a foreign power.

In 1948 the Air Force's Project Grudge, relying heavily on the evaluation by its astronomical consultant, J. Allen Hynek, accepted Arnold's clock-measurement of angular speed but decided that Arnold's translation of that angular rate into a true groundspeed need not be taken seriously. Variations on Hynek's argument (discussed in Section 8) have remained influential ever since, and have often been even less trusting, some critics electing to diminish the angular speed by questioning Arnold's measurement of duration - even implying that Arnold lied about deliberately timing the transit¹⁴⁶ - others going so far as to question Arnold's ability to distinguish the huge belvedere of Mt Adams in the South from the little Tatoosh Range near Mt Rainier.¹⁴⁷

In a recent criticism Belgian physicist Roger Paquay¹⁴⁸ deprecates Arnold's clock-measurement of the 102-second transit and elects to subordinate this to Arnold's guess that the *total* time from first to last glimpse was possibly 2.5 - 3 minutes, objecting that in 2.5 minutes at 1200 mph the objects would have travelled about 58 miles (93km) and that any object ought to have travelled completely out of sight long before reaching the end of this 58 mile track.¹⁴⁹

He then reasons that 2.5 minutes must be an exaggeration and proposes cutting the total duration to 1 minute. The motivation for this is the strange argument that by using a 1 min total duration we can then divide Arnold's 1200mph result by a factor 2.5 yielding an ordinary jet speed of 552 mph (889km/hr).

By this means the duration of the total track, over an angle of at least 120°, is to be rendered 42 seconds *shorter* than the duration that Arnold actually measured using his cockpit clock for the transit of the smaller ~80° angle between Mt Rainier and Mt Adams. This proposal obviously requires that Arnold's clock measurement was not just approximate, but very grotesquely mistaken indeed.

However let us allow it for the sake of argument. Does the revision work? It does not. It merely worsens the problem. Arnold's "1200mph" was not based on the entire angular distance of the track from first to last glimpse (the 2.5 - 3 min track starting far North of Mt Rainier and ending South of Mt Adams), only on the shorter measured interval between the two mountains (1.7 min) which, if the *total* duration is now to be only 1 minute, obviously must have been traversed by the objects in far *less* than 1 minute. If the distance remains a fixed quantity, this exercise has the unwanted effect

144 Arnold, K., and R. Palmer, *The Coming of the Saucers*, Amherst, Wisconsin, 1952, p.14.

145 Broadcast interview of Kenneth Arnold by journalist Ted Smith, KWRC radio, Pendleton, on June 26, 1947

146 Philip Klass "questions whether Arnold -- who was focusing his attention on the unusual objects while also occupied flying his aircraft -- would have taken his eyes off the objects to carefully observe his cockpit clock." Klass, P. J., 'Were Kenneth Arnold's UFOs Actually Meteor-Fireballs?' Skeptics' UFO Newsletter, #46, July 1997

147 In Steuart Campbell's mirage theory. See: Kottmeyer, Martin, "Mirage Sale," *MUFON UFO Journal*, #327 July 1995, pp. 16-18.

148 Roger Paquay, email to Martin Shough 24.11.2009

149 Note a metrical error here. Roger translates "1200mph" as 1200 *knots* or 2222 km/h to get 93 km, when it should be 80km (50 statute miles). See section 2. But we will stay with Roger's 58 miles as it allows us to be conservative

of accelerating the implied absolute speed to a minimum of 2340mph.

Therefore Paquay has no escape but to follow Hynek in concluding that the objects were 2.5 times closer than Arnold believed and travelling 2.5 times slower than he calculated, so that they could have been jets. And if they were so much closer this would explain why Arnold was able to see a resolvable shape¹⁵⁰ But Paquay has not corrected Arnold's calculation for his own re-jigged <1min duration, and instead of $1200/2.5 = 552\text{mph}$ (889km/hr) the true minimum speed should be $2340/2.5 = 936\text{mph}$, which of course is still far faster than any jet or even experimental rocket plane in 1947.

What had worried Paquay in the first place - the reported visibility of the objects all along an implied 58 mile flight path when they would be "far away and out of sight" before reaching this distance¹⁵¹ - is not really a problem. Firstly Arnold's "expert testimony" is relevant to visual conditions that day: He emphasised the exceptional clarity, saying it was easy to discern objects at 50 miles,¹⁵² which is not a meaningful quantity but is indicative and is consistent with available weather data.¹⁵³ Secondly Arnold never said that they were resolvable at the extremes of their range. He stated that it was only by the glint of their bright specular reflections that he was still able to pick them up passing Mt Adams. And if we anchor the southernmost end of a 58-mile track at Mt Adams, about 44 miles away from Arnold, then the other end about 12 miles north of Mt Rainier would be only about 25 miles away from Arnold. In fact he thought they were much further away than this when he first glimpsed them, but again they were not resolvable as more than bright specks until they approached the mountain. So the premise that the objects could not have been seen for the 2.5 minutes reported has no foundation, and the argument raised on it is shaky.

These and similar arguments are not an encouraging advance on the reasonings of Hynek and ATIC in 1947. They are confused, internally inconsistent, and wilfully negligent of report data, and one might be forgiven for thinking that they are designed *ad hoc* to justify disregarding Arnold's clock measurement, and/or Arnold's observation that the objects passed behind known peaks, on the basis that the implied speed is *a priori* "impossible".

Nevertheless, let us assume that Arnold did make a timing error. Arnold acknowledged that timing by the second sweep hand of his 8-day cockpit clock was not precise, as we have heard. But errors of a few seconds are not very material. We need a very substantial error. Let us assume that Arnold misread his clock by an entire minute, so that instead of the second hand just coming up to 2:59 it was actually only 2:58 as the first object passed the southern edge of Rainier. The timing over the 47 mile distance between would then be not 102 seconds but 162 seconds. An error in clock-reading by some multiple of 1 minute is arguably the most plausible type of substantial error in these circumstances and is certainly possible.

However the speed for a 1-minute error is still a startling 1070 mph. If we follow Arnold's own very conservative procedure and reduce the apparent distance flown to about 40 miles the speed remains ~890mph, 265 mph faster than the record for a jet in 1947.¹⁵⁴ To even begin to approach a possible jet speed we would have to first adopt Arnold's conservative distance assumption ("so far on the conservative side that I knew it was incorrect") and still add 2 *minutes* to his clocked time.

150 Arnold did indeed report that he could see a shape, but of course the shape Arnold saw was not the shape of any known jet, so rather than being a solution to our problem this is another instance of it.

151 Roger Paquay, email to Martin Shough 24.11.2009

152 Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/CUFOS files).

153 See Appendix 2.

154 The official world airspeed record of 623.62 mph (1,003 km/h) was set by a Lockheed P-80 Shooting Star piloted by Col Albert Boyd on June 19 1947.

So large an error (>200%), coming from a twice-repeated basic failure to complete a premeditated instrument measurement, seems very implausible without some specific justification.¹⁵⁵ Certainly Arnold must have been in some sort of state of heightened excitement just because these "peculiar looking aircraft" were (he believed) flying unusually fast, but his decision to clock them between landmarks indicates a presence of mind at odds with the speculation that he might have been so spellbound as to miss or somehow forget two complete revolutions of his clock's second hand.

The only other internal check available on the angular rate is a weak one. Arnold's actual timing produces an angular rate of ~ 1.0 deg/sec (see Section 5) and a visual loss inside the cleft that would last less than 1 second. This seems a comfortable fit to the "momentary" disappearance behind the peak of Glacier Island described by Arnold. Re-inserting two hypothetical missing minutes of transit time would push the average rate down to $\sim 0.4^\circ/\text{sec}$, the peak rate at this point of the track being somewhat higher, perhaps $\sim 0.5^\circ/\text{sec}$. At this rate the duration of visual loss of the lowermost objects inside the cleft would be 2 or 3 sec, perhaps no longer quite so "momentary". But this is hardly a strong separator.

In summary, there appears to be no internal reason to question Arnold's timing report, and there is no logical, physical, optical or physiological reason why Arnold could not have seen resolvable objects of the size he described flying the course he said they flew.

Of course consistency and plausibility can't of themselves prove that such extraordinary objects really *did* fly the course he believed they flew. A number of explanations have been proposed over the years, invoking different types of conventional objects misperceived in a variety of ways, and it is to these that we now turn.

155 And has the consequence that an additional 120 sec of flying at 100mph would tend to reduce Arnold's range from the objects, possibly by as much as 3.3 miles below the minimum 16 to 17 miles deduced in Sections 3 - 6, increasing the maximum angular size of conventional aircraft by up to 20%.

10) Explanations

i) conventional aircraft . . .

As discussed in Sections 8 and 9, the earliest "scientific" study of the observation, by Hynek, indicted conventional fighters at a range of only a few miles. In Section 8 it was shown that a mistaken understanding of visual acuity and a reliance on false information in the ATIC case summary led Hynek to conclude that Arnold's statements about distance and size were incoherent; nevertheless Hynek accepted Arnold's timing and simply rescaled his speed calculation in direct proportion to a reduced object range of only six miles, suggesting that they could therefore have been conventional aircraft, fast but subsonic, travelling at about 400mph.¹⁵⁶

In 102 sec a 400mph aircraft travels 11 miles which (assuming for simplicity a path transverse to and bisected by the line of sight) subtends the observed 80° arc with its termini at 8.5mi range, approaching within a minimum of ~6.5 miles, at which distance a typical fighter aircraft in profile subtends a visual angle of ~3.5 arcmin, large enough to be resolvable especially in excellent seeing conditions. This raises the question of why Arnold, expecting to see fighters,¹⁵⁷ and having earlier "merely assumed that they were jet planes",¹⁵⁸ did not simply conclude that the "aircraft" he saw were indeed planes.

Partly of course this was because they seemed such "peculiar looking" aircraft¹⁵⁹ but mostly it was because of their apparent speed, which Arnold judged to be excessive; and crucial to this judgment are the visual cues which convinced him that they were about three times as far away as a fighter would need to be in order to subtend the same visual angle, and three times as large. Foremost among these cues, and the one we can potentially get some sort of a grip on, is that Arnold said he was able to locate the flight path in relation to intervening peaks in at least one place. Hynek's approach was to tacitly discount this part of the observation. But it appears to be an original feature of the narrative, recorded multiple times in early sources (see Section 5) and we have no good internal reason to discount it.

On the other hand, if we are to interpret the report strictly explicitly, only one end of the clocked flight path is anchored by an occultation behind a secondary peak (identified tentatively in Section 6 as Glacier Island).¹⁶⁰ The other end is free to rotate, within the constraint that it pass to the West of Mt Adams so as to allow the *appearance* that the objects passed out of sight towards the South beyond the range of Mt Adams. If a formation of planes had skirted Mt Rainier, a few of them dipping behind Glacier Island,¹⁶¹ and then headed SW across Arnold's course between him and Mt Adams, could they have given the illusion of heading ~170° towards Mt Adams?

Consider Fig 17. If a flight of aircraft on a straight SW course from Glacier Island could pass within

156 This order of speed would be within the envelope of a fighter such as the P-51H Mustang, one of the fastest propeller-driven fighters ever built, capable of 487 mph (784 km/h) at 25,000ft (7,600m).

157 ". . . a bright flash reflected on my airplane. It startled me as I thought I was too close to some other aircraft." (Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/CUFOS files). "My momentary explanation to myself was that some lieutenant in a P-51 had given me a buzz across my nose . . ." (Arnold, K., and R. Palmer, *The Coming of the Saucers*, Amherst, Wisconsin, 1952, p.10.)

158 Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/CUFOS files)

159 *Ibid.*

160 As we have seen (Section 5), Arnold did say that the objects appeared to weave "in and out" among the peaks further South and "went down into the canyons" in several places; but in no early source does he say explicitly that they were lost to sight at these times.

161 The width of the Glacier Island cleft (Fig.7) appears to be well over 600ft (180m) at the approximate 100-ft clearance altitude, so it is quite possible to imagine that fighters could have flown through it with 2 - 300 feet (60-90m) of wingtip clearance either side.

a few miles of Arnold's plane, traversing the measured $\sim 80^\circ$ of angle during 102-seconds, what is the limiting lower bound on speed and distance set by the need for the angular subtense to remain at or below the limit of easy resolution? If they passed about 4 miles off the nose of Arnold's plane on course A as shown in Fig.17 they would subtend a very easily resolvable ~ 5.7 arcmin (1/5 the diameter of the full moon) at point C and their minimum speed would then be about 530mph, a high but feasible speed for the only jet in US service at this date, the F-80 Shooting Star (then still known as the P-80).¹⁶² Increasing the range diminishes the angular size but rapidly nudges an upper limit on the speed required to satisfy the measured angular rate. At 6 miles closest approach they would still subtend about 4.3 arcmin and be travelling over 600mph, which is exceeding the maximum speed of the service P-80. To remove the jets to a distance at which diminished angular size definitely causes their shapes to become unresolvable, more than about 8 miles away, they would have to be travelling at ~ 630 mph, at 9000ft, which is a significantly better performance than the world air speed record set at high altitude by a P-80B (a one-off variant, designated P-80R[XP] s/n 44-85200, specially redesigned as a racer¹⁶³) only five days earlier.

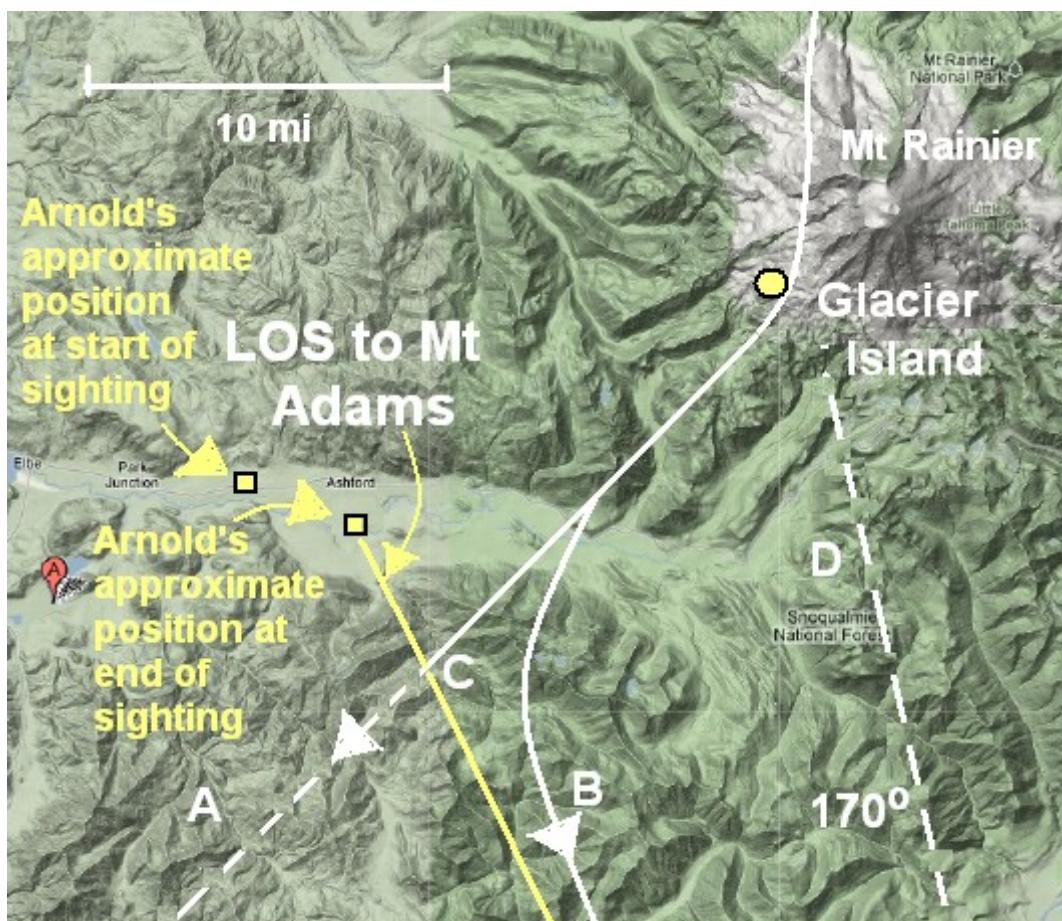


Fig.17 Showing how the occultation of the objects by Glacier Island constrains a possible nearer flight path (approx. scale; see also Sect.10.iv for possible alternative a/c positions)

Remember that these figures are based on assumptions that strongly favour the jet hypothesis, since the positions of Arnold's plane on Fig.17 come from our detailed reconstruction of his flight path (Fig.3) developed in Sections 3 to 6, which tends to minimise Arnold's probable range from Mt

162 The F-80C cruise speed was only 410 mph, max speed 600mph (http://en.wikipedia.org/wiki/P-80_Shooting_Star) Strictly speaking the F-80 designation did not supervene until the AAF became the USAF in 1948.

163 *Ibid.*

Rainier. If Arnold were really 6 or 7 miles further West, or even more, as is usually assumed, then the above speeds would need to be increased by ~125%.

So, course A is (at best) a marginally workable proposition for getting jets from Rainier as far as point C. But, worse, having got the jets to the right azimuth, we then have to get rid of them! Arnold would need to lose sight of them around point C so that they *appeared* to him to recede past Mt Adams whilst in fact they continued unseen along the dashed part of path A. But at this point they would be at least five times closer, and appear five times larger, than they had been when he first picked them up approaching Mt Rainier and thought they *were* jets. So we need to ask what, in the meantime, would have made them look so much less like jets that he was moved to abandon that assumption? Why would Arnold not readily identify nine AAF jets approaching within a few miles? And why, upon their reaching the LOS to Mt Adams around point C, at a *high* angular rate, would he have lost sight of them in such a way as to gain the impression that they were now dwindling in the distance and passing Mt Adams at a low angular rate?¹⁶⁴

As to the first question, the LOS is still almost 80° of azimuth and 60° of elevation away from the sun, so there is no question of them moving "into the sun" and being lost in glare. Arnold's report of locally clear skies with "exceptional" visibility is supported by available weather data (Appendix 2).¹⁶⁵ And in any case an unexplained abrupt disappearance at C, just when the jets - appearing at their largest - are crossing Arnold's course at their *peak* angular rate, would not at all fit the impression of objects receding past Mt Adams, which implies range increasing by a factor 10 and angular size and angular rate both decreasing monotonically in inverse proportion.

It seems therefore that somehow a true recession needs to be combined into this scenario, which leads to the curved flightpath B in Fig.17. This type of course allows the jets to stay near the bearing to Mt Adams whilst dwindling until finally being lost to sight after 2.5 - 3 mins. But clearly there comes a point at which progressively applying this correction causes this type of flightpath to revert back to the 170° heading which Arnold perceived (track D), and we need to make a judgment as to how far in this direction we are able to go, given that for each incremental reversion towards a straight 170° (or similar) flightpath an increase in jet speed is required in order to continue to yield the measured angular rate. The results of this analysis so far suggest that the scope for accommodation here is very limited indeed. In fact it is far from clear that there is any flightpath at all between A and D that is consistent with the constraints imposed by sighting geometry and conventional jet performance.¹⁶⁶

164 "I might add that my complete observation of these objects, which I could even follow by flashes as they passed Mt Adams, was around two and one-half or three minutes, although, by the time they reached Mt Adams, they were out of my range of vision as far as determining shape or form." Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/CUFOS files)

165 There may have been some distant scattered clouds to the east and to the south of Mt Adams, but not locally.

166 There is one other possible objection to a construction like tracks A or B, which applies to some extent to any construction which brings P-80s relatively close to Arnold's position. This is the question of noise - or rather absence of same. During the 102-second timing period Arnold turned his aircraft side-on to the objects and *opened his plexiglass side window* in order to view the objects without any obstruction. Is it possible that nine early-vintage turbojet fighters (or indeed powerful piston-engine fighters; see Section 10.iii) roaring by at a few miles range might have been audible even over wind and engine noise? On track B the jets would turn away and open the range tail-on before reaching point C, but at the same time their jet-pipes would now be pointed towards Arnold; and during approach on either track A or track B they would initially have been no more than about 20° away from a head-on aspect. Either aspect would favour increased exhaust and/or turbomachinery noise. The author sought opinions from experienced pilots and aviation professionals, which can be summarised by saying that it is unlikely but possible. But a definite answer to the question remains wanting. Inquiries to the Skaggit Aero Education Museum who fly an original CallAir A-2 (claimed, erroneously, to be the very machine flown by Arnold; see Section 3, Note 21) went unanswered. This issue possibly merits more investigation; however, one negative piece of evidence is an early photo of Arnold (Arnold & Palmer, *The Coming of the Saucers*, Amherst 1952 p.161) standing in the doorway of his A-2 apparently wearing ear-defenders or radio earphones. Arnold had no radio useable in-flight, "just a small, little radio that I could contact the control tower with"(1977), so probably the former. If he wore these in June 1947 then of course the noise question becomes academic.

ii) . . . plus atmospheric optics?

Perhaps a possible explanation for why Arnold did not recognise these jets at any time for what they were, despite the clear sunny day and excellent visibility, can be found in atmospheric optics. It might also be possible to kill another bird with the same stone.

One feature which helped convince Arnold that he was not seeing any conventional crewed aircraft was the erratic "skipping" or "flipping" motion of the objects, so abrupt that he was sure any pilot would have been "turned to hamburger" in short order. According to Ruppelt, back in 1948 the ATIC aircraft faction suggested that this was a "shimmering" caused by Arnold viewing planes through "layers of warm and cold air like heat waves coming from a hot pavement."¹⁶⁷ Perhaps the same atmospheric refraction effect that made the images of jets leap or skip could have obscured their shapes also?

The difficulties here begin with the facts that the air through which Arnold was looking at 9000ft is not adjacent to a hot pavement, and that even had it been "layers of warm and cold air" implies a stable stratification at odds with the unstable turbulence implied by "heat waves". This is really a very confused idea.

To untangle it somewhat: The temperature lapse gradients causing familiar inferior mirage above a heated road surface are typically large, well over the autoconvective lapse rate of $-3.4^{\circ}\text{C}/100\text{m}$, of course, and often in the order of -5 to $-10^{\circ}\text{C}/\text{m}$, but the gradient is maintained by the "hot-plate" of the ground immediately below, which drives rapid, turbulent vertical circulation. Large temperature lapses are almost always confined to ground effect for this reason.¹⁶⁸ In the free atmosphere at over 9000ft abnormal vertical temperature gradients are very much weaker and are characterised by calm, stable stratification, not rapid, turbulent circulation. Temperature inversion layers are typical rather than extreme lapses, and the conditions - sunny afternoon, "smooth" air, no precipitation and excellent visibility - do tend to indicate stable air that would not be inconsistent with the presence of inversion, as pointed out by ATIC,¹⁶⁹ Menzel,¹⁷⁰ Campbell,¹⁷¹ McGaha¹⁷² and others. But in the free atmosphere stable stratified air - Ruppelt's "layers of warm and cold air" - is, almost by definition, not turbulent air, and, although they may bend light rays and cause mirage, elevated inversions will not of themselves cause a target image to jerk or shimmer in the manner of heatwaves rising off a hot pavement.

The shimmering or jumping effect being suggested implies *unstable* conditions, akin to those that cause stars to flash and twinkle, i.e. to scintillate. This twinkling is caused by meter-scale temperature/density inhomogeneities associated with turbulent convection in the atmosphere. The shimmering or dancing occurs because rapidly fluctuating refractive index gradients cause rapid changes in the optical pathways that combine the image at the observer's eye. Mostly the result is fluctuations in brightness, or colour, caused by out-of-phase interference effects occurring between raypaths of slightly different lengths. Sometimes the source can appear noticeably shifted in position. Because this effect is very tiny it is normally only noticeable in telescopic observations of point sources such as stars, and it is common experience that the larger images of planets such as

167 Ruppelt, Capt, E.J., *The Report on Unidentified Flying Objects*, Ace Books, NY 1956, p.28.

168 Vizee, W., 'Optical Mirage', in: Gillmor (ed.) *Scientific Study of Unidentified Flying Objects*, Vision, 1970.p.618

169 "It is the Air Force conclusion that the objects of this sighting were due to a mirage. Mr Arnold's statement concerning how smooth and crystal clear the air was is an indication of stable conditions. These stable conditions are associated with inversions which increase the refraction index of the atmosphere." Project Blue Book file, [Incident #17 Mount Rainier, p.3](#)

170 Menzel, D.H., *Flying Saucers*, Harvard University Press, Cambridge, Mass., 1953

171 Campbell, S., *The UFO Mystery Solved*, Explicit Books, 1994

172 McGaha, James, 2006. Interview by Joe Nickell, September 28-29, quoted in: Joe Nickell, 'Mysterious Entities of the Pacific Northwest, Part II', *Skeptical Inquirer*, Volume 31.2, March / April 2007.

Jupiter or Venus do not twinkle; but in abnormally turbulent conditions near the surface of the Earth the angular deviations in the raypaths can amount to many arcseconds, sufficient to cause some perceptible shimmering of the images of planetary discs having the same order of angular diameter.

The characteristic shimmering in the "road mirage" alluded to by Ruppelt is an extreme example of the same phenomenon. Although stellar scintillation can be observed in the thinner and less-unstable air at high altitudes, "road mirage" conditions are not directly comparable with any that occur in the free atmosphere at altitudes of thousands of feet. In any realistic case of scintillation at 9000ft the angular excursions will be small, rapid and also random directionally - i.e., the raypaths deviate in a random walk around the mean axis, not preferentially in a vertical direction. Referring to the jet scenario explored above, Arnold's resolvable objects are far larger than point sources and approaching an order of magnitude larger than planetary diameters. They are too large to suffer bulk displacements comparable in extent to their own angular size as a result of scintillation.

To put a few numbers on this: Typical stellar image excursions due to turbulent seeing near the horizon are in the order of "a few seconds of arc".¹⁷³ Because refractive-index fluctuations are proportional to atmospheric density the siting of observatories at altitude can reduce this problem, and the best mid-latitude, high-altitude sites "have a median seeing ranging from 0.5 to 1.0 arcsec".¹⁷⁴ Image excursions of this magnitude are negligible in relation to an image size of $\sim 180 \times 9$ arcsec and so could not cause our jets to be discontinuously bulk-shifted. Even 10 times this amount could only cause their images to be to some degree blurred. And remember that these scintillation values index the effects of the *entire airmass*, where every meter of raypath through the atmosphere over distances in the order of 100 miles contributes to the eventual image displacement. A very short raypath of just a few miles could achieve only proportionately small action, and at 9,200ft where the density is about 70% of the sea-level density this short raypath would incur mean angular image excursions about 30% smaller on average even than the same short path at sea level. In short, in the conditions of this sightingm scintillation effects due to turbulence on the appearance of jets would be negligible, and on the motion of jets, imperceptible.

So the "heat shimmer" theory to explain why the objects were seen to skip "like speedboats on rough water" is inappropriate unless we can find some elevated equivalent of a hot road surface near 9000ft. Perhaps we need look no further than the aircraft itself and the radiation or convection from a hot sunlit wing or engine compartment?

But the wings and fuselage of the CallAir were fabric over a light tubular frame. There were no expanses of metal that might have caused this effect¹⁷⁵ except possibly the engine cowling panels over the nose, and the objects were seen mostly out of the side window, only for a limited time through the front windscreen across the nose. Initially as we can see from the map (Fig.3) they were sighted near Arnold's nine- or ten-o'clock already exhibiting the "dip" every few seconds that caused a bright specular reflection, and of course these bright flashes had been what attracted Arnold's attention to them in the first instance. In this same fashion the objects approached and crossed the face of Mt Rainier, and by the time they had reached a position near point X on Fig.3, directly off the nose of the aircraft, Arnold was making his turn in order to keep them in view through the now-open side window. Arnold then "observed them quite plainly" as they continued to "flip and flash in the sun right along their path" to the side of his plane.¹⁷⁶ So a hypothetical hot engine cowling is not relevant. The engine exhaust would be a source of hot air, but for obvious reasons is located below the nose so as to vent underneath the wings, not over the cockpit. And in

173 Reiger, S. H., 'Starlight scintillation and atmospheric turbulence', *Astronomical Journal*, Vol. 68, p. 395 (1963).

174 Lawrence, J. S., et.al., 'Exceptional astronomical seeing conditions in Antarctica', *Nature* 431, 278-281 (2004)

175 Arnold remarked, "About the only thing on my ship that is metal is the engine" (*Coming of the Saucers* p.41). Even the propellor was made of wood.

176 See Section 10.iv.d) for discussion of reasons why it is unlikely that Arnold turned left to view the objects through the right side window. But in either case the LOS stays well clear of the engine cowling for most of the sighting.

any case it strains credulity that an experienced pilot with thousands of hours in the same CallAir would be so silly as to *a*) not recognise the effect of heat shimmer caused by his own engine, and *b*) not notice that the whole mountain horizon was shimmering as well as the objects.

But there is one possible mirage effect which we have not yet ruled out and which might cause intermittent image displacement. This could occur even in highly stable, non-turbulent conditions if the light rays from hypothetical jets passed in and out of a sharply-defined layer of anomalous refractive index gradient because of varying relative altitude. The appearance of sudden changes in absolute height of the jets is what we are trying to explain away, of course. But what if Arnold was himself flying close to the lower boundary of a sharp inversion layer so that fairly small fluctuations in his own altitude might cause his eye to move in and out of the layer? The changing raypaths might cause the images of the jets to be displaced upwards each time, effectively by an intermittent superior mirage.

Arnold said he had "trimmed his plane out for Yakima and sat back to admire the view". There is no indication that he was changing altitude deliberately. Height undulations might be caused by slight turbulence below the inversion, but bumpy flying conditions are explicitly counterindicated: Arnold made a point of noting the exceptional smoothness of the air that day - this being one factor which leads to the suggestion of mirage in the first place. Conceivably, long, slow, almost imperceptible mountain waves could have been triggered in the northwesterly airstream by uplift over the Olympic Mountains 100 miles or more distant. Of course you might expect a sharp inversion layer to be affected by these gravity waves even before the aircraft. An equivalent possible scenario, then, would be waves propagating across the inversion surface so that the inversion level rises and falls whilst the plane (having no pressure-following autopilot) remains at roughly constant height.

In any case, let us allow that Arnold might have dipped in and out of an inversion layer of large horizontal extent.¹⁷⁷ We can then calculate the amount of image displacement that could realistically be caused by a given temperature/refractive index gradient acting over the thickness of a given airmass.

Taking as a practical limit a severe trapping gradient of $+11.6^{\circ}\text{C}/100\text{m}$ then we could expect up to 33arcsec/km of ray bending, which over a raypath of, say, 5mi (8km) would allow a maximum vertical displacement of 4.4arcmin , which is not large but certainly perceptible. The problem is that parallel light rays reaching Arnold from, say, the backdrop of Mt Rainier - more than three times as far away at a minimum distance of 16mi (26km) - would simultaneously be bent more than 3 times as much, by 14 arcmin. This rather large simultaneous distortion of the background mountains, over an angular distance half the diameter of the moon (or sun), could hardly fail to be much more noticeable than a smaller effect on the foreground jets. Even if one makes the highly artificial assumption that the mirage duct ends immediately beyond the range of the jets (and this fortuitous coincidence needs to be maintained along the course of the jets whilst their range from Arnold is itself varying by a factor 3) there would still be a looming effect on the mountains of the same perceptible magnitude as the displacement of the jets.¹⁷⁸

177 Let us at the same time ignore the fact that jets "on the horizon" (see Section 6) would be about 1.6° below the astronomical horizon (the tangent plane passing through Arnold's eye), which strictly speaking is 3 times the critical grazing angle for light rays from these nearby jets to couple into a mirage duct containing Arnold's eye, implying that only the topmost planes in the formation, approaching 1° above the horizon, are likely to have been selectively affected.

178 Well-developed inversions at altitudes above the bulk of boundary layer effects often extend huge distances, commonly well over 100km (60 mi) and the exceptionally smooth conditions reported might well favour extensive stratification (Viezee, W., 'Optical Mirage', in: *Scientific Study of Unidentified Flying Objects*, Gillmor (ed.) Vision Press, 1970). Continuing to assume that coupling of rays from the landscape into the mirage duct is possible at the dip angle obtaining in this case, the effect on Mt Adams and other Cascades peaks in the same line of sight as the jets at similar distances would also be dramatic, with ray bending of almost 40 arcmin potentially throwing inverted mirages of the landscape into the air by an angle larger than the diameter of the moon. Peaks on the far horizon over 100 mi (160km) away could simultaneously be displaced through an angle 20 times as large as the jets or $1^{\circ}26'$ of arc.

And we come back again to the underlying question: "What jets?" If anyone should have known whether or not a flight of nine jets had been racing across Washington that day it was of course the Army Air Force. The only operational US jet fighter at this date was the Lockheed F-80 Shooting Star¹⁷⁹ and the only service arm likely to have had nine operating in the Pacific Northwest in June 1947 is the Army Air Force.¹⁸⁰ Recall that ATIC consultant Hynek made an official case for military aircraft - not even jets but possibly fast-subsonic piston-engine fighters capable of over 400mph. It may be thought significant that although ATIC strongly approved of the tenor of their consultant's reasoning they did not accept his conclusion. It would have been the simplest, most obvious solution. Yet so far were they from being able to account for the presence of any suitable aircraft, even subsonic ones,¹⁸¹ that the final ATIC evaluation on the Project 10073 Incident #17 file Record Card is instead "OTHER (MIRAGE)".

iii.) . . . and Navy camouflage?

We have seen that only if the objects' flightpath can be unpinned from Glacier Island at the north end, and from Mt Adams at the south, with both ends being brought within a relatively few miles of Arnold, would the Hynek theory be workable in principle (at least in terms of angular speed alone). But no evidential justification for this has yet been made clear. It is in conflict with several structural features of the original report. And in practice there is the question of where such aircraft might have come from, apparently unknown to the Army Air Force.

One possible answer to that last question has been offered by French researcher Eric Maillot who suggests that they were Chance Vought F4U *Corsair* fighters flown by the Navy. The F4U was one of the most powerful piston-engine fighters ever built, capable of a top speed well over 400mph which would suffice for Hynek's scenario, and it is reasonable to think that the AAF may not have known of all Navy aircraft movements. There is at least no evidence that they attempted to find out. The other essential new element of Maillot's thesis is that one camouflage paint scheme (of many) used on Navy *Corsairs* involved sky-blue paint on the tail, which could render the tails difficult to see against the sky. Could this explain Arnold's puzzlement about these odd shapes with no tails?

This is a very interesting proposal which deserves careful consideration, but of course depends crucially on making Hynek's scenario credible. What follows is a critique of a core section of Maillot's thesis¹⁸² entitled 'Distance and speed questionable' (translated here by the present author from the original French) which seeks to pre-empt possible criticism of the F4U theory and defend the Hynek scenario. Maillot begins:

Kenneth Arnold estimated the size of the objects to be 40 to 50 feet at a distance of 15 miles (25 km).

There are several errors mixed up here. Firstly, the figure cited (from the ATIC file and thence other sources such as Ruppelt) should be "45 to 50 ft"; secondly there is no evidence that this "45 to 50ft" came from any source attributable to Arnold; and thirdly the ATIC file gives this figure in two contradictory forms, both of which are wrong: *a)* as Arnold's estimate of the absolute size of the

179 There was no private jet aviation in this era. The first commercial jet was the ill-fated De Havilland *Comet* flown briefly by BOAC in Europe from 1949. The first US private jets flew in 1958

http://www.centennialofflight.gov/essay/Commercial_Aviation/Opening_of_Jet_era/Tran6.htm

180 Three or four of the original P-80 demonstrators were transferred to the Navy, and were being adapted for carrier trials during 1946 and 1947 at Patuxent River NAS and Norfolk Naval Base, both on the Chesapeake Bay on the US east coast. See http://en.wikipedia.org/wiki/P-80_Shooting_Star

181 It is an interesting coincidence that preparations were underway at Pendleton Municipal Airport to host a "60-plane air fleet, a tri-state air tour to promote private aviation for business concerns" scheduled for Jun 25 1947 (Gross, L., *UFOs - A History: 1947*, privately printed, Fremont CA 1988 p.6). But these would have been small piston-engine planes with performances far inferior to the military fighter speeds required, so it is merely coincidence.

182 <http://cnegu.info/manuals/karnoldv2.pdf?osCsid=3fa41e69511b732587e9531183b982cd>

objects (incorrect; in all known sources Arnold estimated ~100ft); and *b*) as the outer-engine span of a DC-4 which subtended an equivalent angle at an estimated 15 miles (again incorrect; the outer engine span of a DC-4 is almost 60ft). See Section 8.

The length of an F4U is less than 40 feet which gives a maximum distance of 10 miles for visibility. Based on the calculations of J. A. Hynek . . . we arrive at a distance [of] about 6 miles (9.6 km). He obtained a speed estimated at 400 mph for the "UFO." This value is perfectly consistent with that of F4U Corsairs.

Hynek's reasoning remains valid only to the extent that it may be possible to get the aircraft onto an 11-mile flight track subtending 80° of arc and passing within 6 miles of Arnold. And because a 40ft aircraft subtends a comfortably-resolvable 4.3 arcmin at this range Maillot's tail-camouflage proposal has some value in helping to account for Arnold's inability to identify them as the aircraft he initially believed them to be. But there really is no good internal reason to discount observational evidence of the objects' course behind Glacier Island, which is a structural feature of the narrative mentioned in the earliest press sources, consistently maintained by Arnold in later detailed accounts and drawings, and found to be compatible with topography and sighting geometry. Neither does the required course adaptation for the simple Hynek theory (never more than about 8 miles from Arnold in order to pass within 6 miles and satisfy the airspeed and the angular rate) naturally explain the angular dwindling of the objects to unresolvable specks in the line of sight to Mt Adams, as reported, which requires one of the class of asymmetrical receding solutions illustrated in Figs.13 and 17 (see also Section 10.i above). Solutions of this type rapidly increase the minimum airspeed above the maximum for piston-engine aircraft, in the limit of the 170° straight heading perceived by Arnold.

[The F4U speed] is also four times that of the CallAir flown by Kenneth Arnold when in cruise (according to a commonly accepted estimate). We now understand why KA found them very fast.

Maillot implies that Arnold would have been surprised by another plane travelling four times his own speed. Presumably he was deceived by the speed of these 400mph *Corsairs* into concluding that he was seeing something exotic and unexplainable. But according to his Air Force report, when he first saw them "approaching Mt Rainier very rapidly" he "merely assumed they were jet planes",¹⁸³ which of course might easily fly half as fast again as F4Us, at 600mph, and after further consideration he concluded that they were probably AAF rockets flying even faster. This escalation was not because they impressed him as being "very fast" compared to his CallAir, as Maillot implies. Such a judgment had already led him to think they were ordinary jets and "their speed at the time did not impress me particularly, because I knew that our Army and Air Forces had planes that went very fast".¹⁸⁴ It was because he then made a *test* of that judgment by deliberately timing their flight on his cockpit clock that he concluded they were travelling at least twice as fast even as jets, and at least three times as fast as *Corsairs*. But he still did not conclude that they were anything more exotic than experimental rocket planes.¹⁸⁵

183 Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/UFOS files)

184 *Ibid.*

185 It is highly relevant here to note again that there was no such ready-made cultural pigeon hole as "UFOs" available to Arnold. In later times the existence of such a category has acted as an attractor in interpretative phase-space, a minimum-energy well into which the phase-point of a witness's assumptions can most readily drop. Typical characteristics of that attractor are properties like "enormous, interplanetary speed", "disc shaped", "non-inertial turn", "bright lights" etc. This constellation of features is now very familiar to us by the label "flying saucer"; but for Kenneth Arnold on June 24 1947 it did not exist, and the corresponding minimum-energy attractor for his perceptions of high airspeed lay in the sphere of military aviation.

It is useful here to recall the various estimates of speed data by KA: originally revised from 1700 mph down to 1200 mph in his statement to the East Oregonian of June 25

Maillot is here planting the idea that if Arnold arbitrarily guessed widely differing speeds from the same set of observational facts within two days then his observations are clearly too shaky to be trusted. But that is highly misleading. Arnold explained in several places why he *deliberately* did this (and had he not openly told us about it himself we would never even know that he had done it). He was all too well aware that the >1700mph he calculated with the help of the group of pilots and others who met him at Pendleton was "incredible", and elected to use very conservative assumptions which might absorb possible sources of error, so that 1200mph was "the best calculation I could figure out, even in spite of error."¹⁸⁶ This seems wholly responsible. Why Maillot would prefer Arnold *not* to have been highly conservative is unclear.

and then to "over 800 mph" in a radio interview ... It is clear that KA has never been able to provide reliable data to calculate a reliable speed.

This is a wilful misrepresentation of Arnold's statements. He did not "revise down" the objects' speed to "over 800mph". In the referenced interview Arnold used the same conservative 1200mph figure he had given to the papers, but went on to say that the measured speed was so high that *even if* one were to assume a further large error in his 102-second timing it would remain extraordinary - "give them three minutes or four minutes to make it," he pointed out, "and they're still going more than 800 miles an hour."¹⁸⁷

He did not know the actual size and actual distance (estimated at 50 miles) of the objects.

Of course Arnold made only informed guesses about the course and size of the objects. Where Maillot's "50 miles" comes from is uncertain¹⁸⁸ but it is not a pertinent figure. Arnold variously estimated his closest distance as about 25 miles, 20-25 miles and 23 miles based on known topography (as we saw in Sections 3 - 6 he was probably somewhat closer).

Worse, he does not take his cues (Mt Rainier and Mt Adams) from a fixed point, as would be necessary to do this kind of calculation, since he is approaching (during 102 s of flight) with a course turn to complicate everything!

Arnold was perfectly aware of the uncertainty introduced by this, and said so.¹⁸⁹ This was one of Arnold's stated reasons for using the highly conservative approximation which Maillot finds objectionable. But in fact this source of uncertainty is small, the change in relative bearing to Mt Adams amounting to only a few degrees (see e.g., Fig.3) which has only a negligible effect in the order of about 2% on the measurement of angular rate.

Note also that the timing is strange, it is based on the first object seen from the top of Mt

186 Broadcast interview of Kenneth Arnold by journalist Ted Smith, KWRC radio, Pendleton, on June 26, 1947

187 *Ibid.*

188 It is probably a misunderstanding. The only findable reference by Arnold to "50 miles" is this: "the air was so clear that it was very easy to see objects and determine their approximate shape and size at almost fifty miles that day." (Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947; NICAP/UFOS files). Another possible source is the late John Keel, who may have made the same error: ". . . the UFO literature to this day prints a false description of what Arnold saw, and if you go and read Kenneth Arnold's own account of it you'll see he saw lights, and saw them from a great distance, from 50 miles away." (July 12 1992 interview of John Keel by Kenn Thomas <http://www.radiomisterioso.com/2009/07/20/john-keel-interviewed-by-kenn-thomas/>)

189 "Considering that I was flying all the time in the direction of their formation this determination can only be approximate, but it is not too far off." (1952) "I realized that my attempt to clock their speed absolutely accurately would have been hopeless because I was rapidly approaching Mt. Rainier at 9200 ft at about a hundred miles an hour." (1977)

Rainier but then the last (instead of first) objects from the Mt Adams to the end. It is not very coherent as he does not know precisely the length of the chain of 9 objects.

This is not at all "strange" but again is deliberate, well-motivated and conservative. There is a very clear explanation of why Arnold did this, and he was again explicit about it. Note that this procedure, which Arnold adopted to compensate for the uncertainty introduced by his necessarily skewed perspective, works to *minimise*, not exaggerate, the measured angular rate. (See Section 9)

All these mistakes combine to make the data unreliable and hence his calculations also. Moreover, the exact position of KA at the time of observation suffers from severe approximation in terms of his projected path on the ground.

Maillot's censure of "all these mistakes" is ill-judged and misses its target. He has not established that Arnold made a single "mistake". He has himself made several, however, and thereby serves only to advertise the poverty of his own reasoning and a poor familiarity with the case materials.

Instead of interminable debates on the limits of the resolving power of the eye on a blue sky, a test with an F4U (actual size or model) in three camouflage colors could be done to forestall new sterile debate.

This would be a very useful type of experiment to conduct. However it should be noted that Arnold reported observing the objects' strange shapes "quite plainly" in silhouette against the bright sunlit snowfields of Mt Rainier and Goat Rocks as well as against the sky. By far his best opportunity for seeing these silhouettes was, as he himself said (and as the sighting geometry demonstrates), when they transited the white sunlit background of Mt Rainier. Several of the objects were also at various times seen against the sky and against other snow-free terrain. It seems doubtful that the same camouflage scheme could have obscured the tails equally effectively in these various conditions.

When such a verification is made, we must consider that KA was able to see the engines of a DC4 (because it is a comparison of angular size, which is based on the separation between engines 1 and 4 of DC4) and ask what is the maximum distance at which it would be possible to perceive the presence of one of its engines?

Thus Maillot would have the DC-4 closer than Arnold's estimate of about 15 miles, which agrees with the inference made here (Section 8) that for comfortable identification the DC-4 should probably be somewhat (perhaps 15%) closer than Arnold judged. Of course this implies a larger angular subtense for the objects, bringing hypothetical *Corsairs* 15% closer also. Maillot, however, wants them 500% closer:

This would test whether the distance of 15 miles (approx 25 km) to the DC4 was well estimated by KA, which may be in doubt: such an engine not exceeding 2.5 m (or 8 ft) would hardly be discernible beyond 3 miles (approx 5km). This would indicate a possible miscalculation by a factor of 5 on distances from K.A.

Maillot's figures yield an engine subtense of ~1.7arcmin. Normal resolution acuity is better than this at 1 arcmin or less, and in practice *detection/recognition* depends on other types of acuity, as well as knowledge, and could be better still. However, this eccentric suggestion implies that the objects, comparable in angular size to the outer-engine spacing of the DC-4 at a range of 3 miles, were 13 arcmin across, which would bring Maillot's nine F4Us thundering by within 1.7 miles of Arnold's open cockpit,¹⁹⁰ each one nearly half the size of the full moon and surely impossible to mistake.

¹⁹⁰ The massive 2100-2400hp radial engine in each F4U, the biggest piston engine ever installed in a fighter, was 20 times as powerful as Arnold's own plane and would have put out a terrific roar, whilst the high-frequency noise from its

The camouflage theory also suffers from neglecting Arnold's very early statement from June 26 1947 that he himself considered exactly this possibility, having initially assumed they were planes:

I thought, well, maybe something's wrong with my eyes and I turned the plane around and opened the window, and looked out the window, and sure enough, I couldn't find any tails on 'em . . . They looked something like a pie plate that was cut in half with a sort of a convex triangle in the rear. Now, I thought, well, that maybe they're jet planes with just the tails painted green or brown or something, and I didn't think too much of it, but kept on watching them.¹⁹¹

Two days later Arnold was interviewed for his home town newspaper, which once again reported his initial belief that they were jets:

Arnold, who returned Friday to his home on the bench above Bradley airport, said he saw outlined against the snow on Mt.Rainier a single-file line of flying objects . . . Arnold said when he first saw the objects, they were coming in a line around Mt. Rainier from the north. As he saw them against the snow of the mountain, and saw the sun reflecting individually from the objects, he said he thought they were jet aircraft.¹⁹²

But as he observed the objects more closely in silhouette "against the snow . . . on Mt. Rainier and against the snow on Mt. Adams as they were flashing, and against a high ridge that happens to lay in between Mt. Rainier and Mt. Adams"¹⁹³ the absence of tails and an unfamiliar disc-wing planform led him to abandon the camouflaged-jet theory. Later he re-emphasised this point:

I felt sure that, being jets, they had tails, but figured they must be camouflaged in some way so that my eyesight could not perceive them. I knew the Air Force was very artful in the knowledge and use of camouflage. I observed the objects' outlines plainly as they flipped and flashed along against the snow and also against the sky.¹⁹⁴

Mailot's is an interesting hypothesis, despite being presented in a context of flawed justifications. But we can only justify pursuing it by following Hynek's lead and setting aside unambiguous original report descriptors, indicating a distant flightpath, which we have no independent reason to believe are ill-founded. This is open to the charge of being arbitrary and *ad hoc*, therefore the result needs to be compelling.

One other obvious objection to Mailot's 400mph *Corsairs* is that although they *could* fly this fast there is no clear reason why they should. It has been pointed out that the cruise speeds of prop aircraft of this type would have been in the region of half this speed. Apart from being fuel-inefficient for sustained cross-country flight, maximum power settings would not be selected outwith combat or very special situations because they "absolutely hammer the engines".¹⁹⁵

A further problem was raised on a French language sceptical discussion forum.¹⁹⁶ Members pointed

proportionately-large 4-bladed, 13ft propellor and wing-root air intakes (the sound of which gave the Corsair its Japanese nickname, "The Whistling Death") would travel especially well. Nine of these aircraft passing at less than 2 miles range, all pushing maximum revs with a total horsepower 200 times the horsepower of Ken Arnold's own engine, might have a chance of being audible with an open canopy, even cross- or downwind. But see also Note #157)

191 Broadcast interview of Kenneth Arnold by journalist Ted Smith, KWRC radio, Pendleton, on June 26, 1947.

192 *Boise Statesman*, Boise, Idaho, June 28 1947

193 *Ibid.*

194 Arnold, K., and R. Palmer, *The Coming of the Saucers*, Amherst, Wisconsin, 1952, p.10-11.

195 Email to the author from aviation consultant A. M.Coupland, 09.07.2010

196 <http://sceptic-ovni.forumactif.com/cas-ufologiques-f4/> His position is summarised in message #225 of this thread.

out that Maillot's distinctive 3-colour camouflage scheme had been discontinued, with all of those powerful F4Us having been overpainted in a different livery before June 1947.¹⁹⁷ French journalist Dominique Caudron adapted to this by proposing that fast, camouflaged F4Us were not necessary anyway. Slower planes cruising at well below maximum power would at least address the objection about wasting fuel and risking unnecessary engine wear.

Caudron claims that the sighting is explained "from A to Z" by US Navy Douglas *Dauntless* dive bombers being ferried in a routine repositioning from the Naval Air Station on Whidbey Island to NAS San Diego on a designated air route known as J5, which would have passed close to Arnold's position. The *Dauntless* has just the right cockpit windshield profile, Caudron thinks, to reflect the sun and account for the brilliant flashes observed by Arnold. Caudron's model has the planes passing within 3.8 miles. But there are several further problems with this variant of the theory.

Firstly, a 10m long *Dauntless* passing at 185mph cruise within 3.8 miles of Arnold and subtending 5.6arcmin¹⁹⁸ would present a larger and more comfortably resolvable profile, which considerably increases the likelihood that Arnold would be able to see the tails of these objects, which he "observed quite plainly" silhouetted against the snow on Mt Rainier and against other terrain (even assuming an hypothetical camouflage paint scheme for which there is no evidence).

Secondly it also worsens the problem of how these aircraft are supposed to rapidly dwindle to unresolvable specks in the angular region of Mt Adams. Consider Fig.18a. At Arnold's position X the lead aircraft is on LOS A at 3.8 mi range from him. At Arnold's terminal position Y, the lead aircraft is on LOS B but now is only 3.2 mi from him (trailing aircraft are a little closer). Arnold has had the advantage of seeing the planes rotate through nearly 90° of aspect, and now sees them closer, at a small depression angle ~600ft below him, their broad-chord, 12.7m wingspans tilted towards him, subtending fully 8.5 arcmin and becoming increasingly favourably sunlit, thus growing larger and if anything *more* distinct during the sighting.

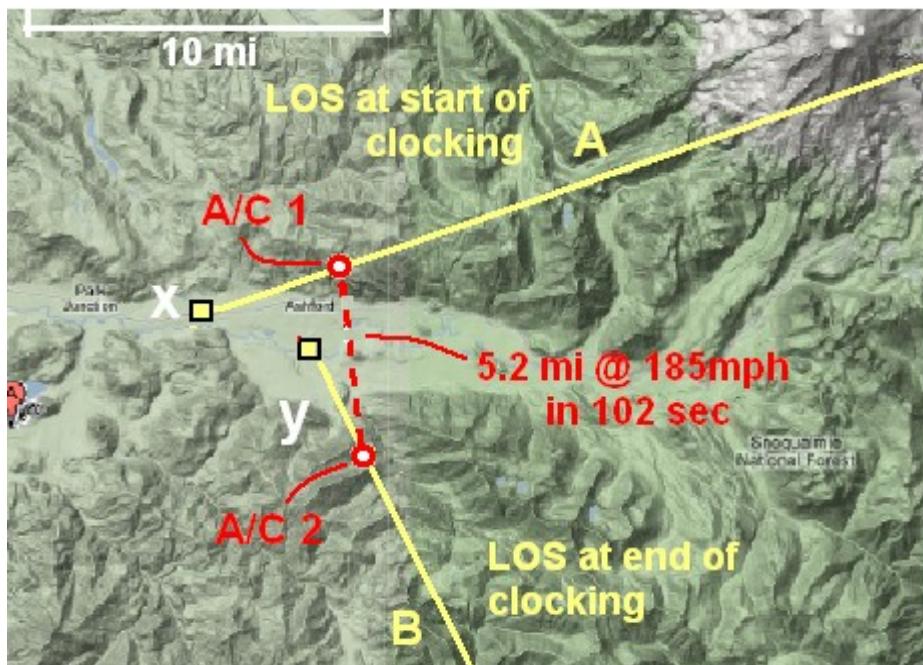


Fig. 18.a. Geometry of a US Navy plane encounter (see text and inset Fig.18.b)

¹⁹⁷ In fact this was only one of at least 222 recorded F4U wartime paint schemes, the vast majority of which had not featured a sky-blue tail. See <http://wp.scn.ru/en/ww2/f/571/3/0> Most F4Us were painted uniform dark blue.

¹⁹⁸ Caudron apparently calculates 9 arcmin, but confusingly also gives an a/c length of 8.1m. The late model SBD 5 & 6 were 10.09m long, the original XBT-2 and intermediate versions being just a little less than 10m long.

<http://www.aviation-history.com/douglas/sbd.html>

Thirdly the Douglas *Dauntless* was an ageing US Navy carrier aircraft and was being replaced in service even during the war. By the end of the war in 1945 it had been fully retired¹⁹⁹ in favour of the SB2C *Helldiver*, and it seems highly unlikely that the *Dauntless* remained flying anywhere, and certainly not in any numbers, by 1947. It is perhaps especially unlikely that any were at Whidbey because although the *Dauntless* was the dominant type there in 1944, at which time they may well have rotated them down to NAS San Diego, there were no small aircraft at all based there by 1947.

During 1945 to 1950, Whidbey was the base for three patrol bomber squadrons, VPHL-7, VPHL-10 and VPHL-12²⁰⁰ "deployed on a three-up and six-month back rotation from Kodiak, Alaska" along with FASRON 12²⁰¹ A FASRON is a maintenance and repair squadron that operates no planes of its own, and VPHL signifies "heavy" (H) "land" (L) patrol bombers, or in other words 4-engine land-based heavy bombers, not single-engine carrier planes like the *Dauntless*. The planes of the VPHL squadrons based at Whidbey in 1947 were PB4Y-2 *Privateers*,²⁰² variants of the famous B-24 Liberator (which incidentally had a very large and conspicuous tail fin).

Another contributor to the forum discussion between Caudron and Mailot suggested that Arnold had seen the last flight of a group of *Dauntlesses* being ferried from Whidbey to their final resting place in the desert of Arizona at Davis-Monthan AFB (3049th Aircraft Storage group; in fact Navy planes went to NAS Litchfield Park near Phoenix). But this proposal should be seen against the following background. The *Dauntless* was 1930s technology that was already being replaced during hostilities, and was retired at their close. At the end of the War in the Pacific many thousands of Navy planes of types far more valuable than the ageing *Dauntless* were decommissioned and scrapped *in situ*, buried in Pacific trenches, only their engines and avionics being shipped out to central depots. By autumn 1945 the Whidbey Island base was downgraded to reduced operational status pending expected closure along with all Pacific Northwest NASs. The entire base maintenance and aircrew infrastructure was dismantled and any *Dauntlesses* would have gone, one way or another. As it turned out Whidbey was preserved to become home base to the heavy patrol bomber squadrons which rotated up to Alaska as part of the emerging Cold War military posture.

Only advanced and valuable aircraft types would have been preserved anywhere for two years, and then there would need to be strong reasons for expensively ferrying them to boneyards like Litchfield Park. Had any *Dauntlesses* remained stored at Whidbey, by June 1947 no aircrew there would have been "current" on the type in terms of their licence endorsement. Had anyone been motivated to crew them and fuel them up in order to fly to a boneyard perhaps 1300mi (2000km) away, they would have needed extensive overhaul after sitting inert for two years in a saline environment. And they would have been worth nothing to anyone when they finally got there.²⁰³

iv.) American White Pelicans

It is probably true to say that this hypothesis effectively captured the sceptical market almost as soon as it was first mooted in the late 1990s by James Easton,²⁰⁴ building on an earlier suggestion by Martin Kottmeyer²⁰⁵ that Arnold saw a flight of swans. When Easton made inquiries of ornithologists in the Pacific Northwest, asking "If Arnold saw birds, what sort of birds could they have been?" the prompt answer came back, "American White Pelicans".

199 <http://militaryhistory.about.com/od/worldwariiaircraft/p/dauntless.htm>

200 'Dictionary of American Naval Aviation Squadrons, Vol.2' <http://www.history.navy.mil/branches/dictvol2.htm>

201 <http://www.mybaseguide.com/navy/whidbey-island/>

202 http://en.wikipedia.org/wiki/Consolidated_PB4Y-2_Privateer

203 Thanks to aviation consultant Andy Coupland for much valuable information and perspective (emails 13.07.2010)

204 Easton, J., *Voyager Newsletter* no. 10, privately circulated, April 07 2000. See:

<http://www.ufoupdateslist.com/2000/apr/m07-018.shtml>

205 E.g., Kottmeyer, M., *Resolving Arnold - Part 2: Guess Again*, REALL Newsletter July 1997

<http://www.reall.org/newsletter/v05/n07/resolving-arnold-part-2.html>

Easton went on to argue that there are several strong points of similarity between pelicans and what Arnold saw, in terms of shape, brightness/colouration, flight patterns and general habits. The theory does require us to discount or suppress certain report features (see Section 6, Fig.11), as does the aircraft theory, in order to get the objects close enough and slow enough; but other matches seem rather persuasive. On the face of it, it "rings true".

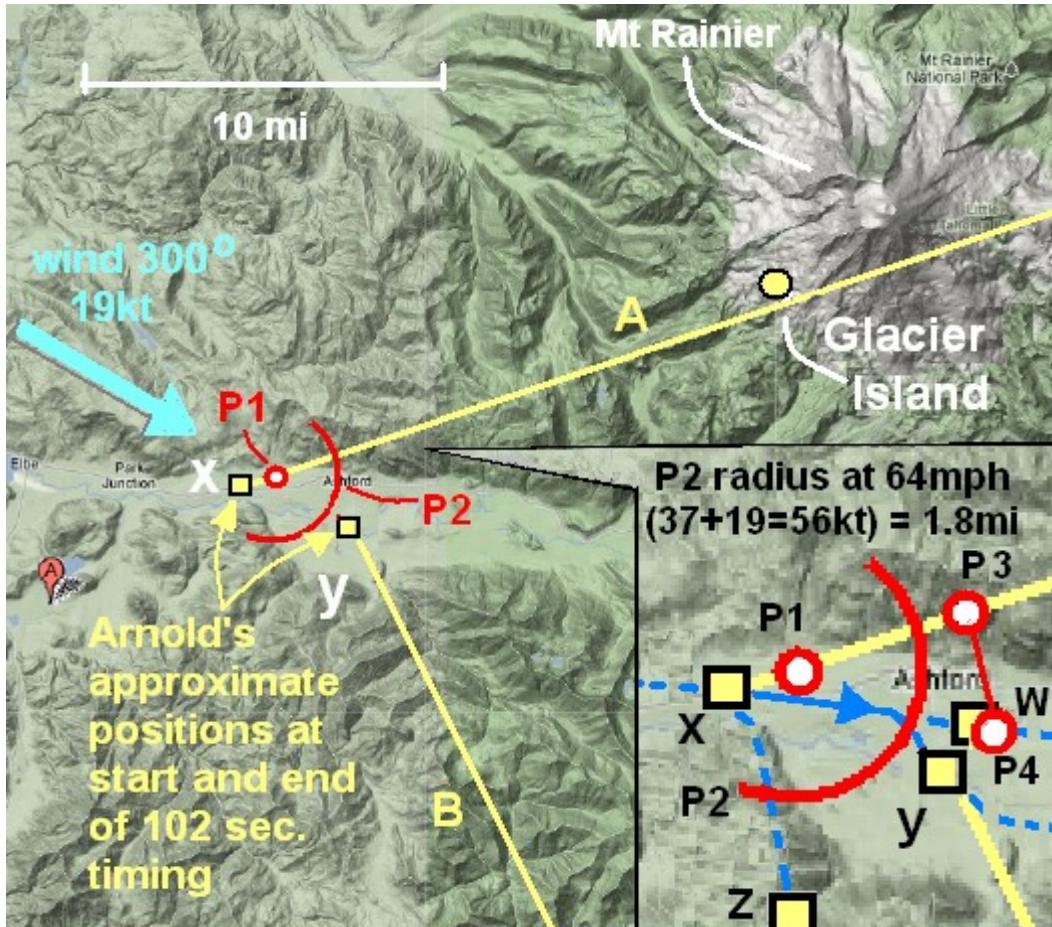


Fig.18b Geometry of a pelican encounter for various CallAir paths (see text).

There are no resident or breeding birds in W Washington, but recently the Vancouver ornithologist who responded to Easton's original query, Michael Price, offered two possibilities to account for American White Pelicans flying near Mt Rainier in late June in the nesting season. The first was adult migrants from a Canadian breeding colony in British Columbia heading south to Californian wintering sites. The second was immature, vagrant non-breeders that had wandered away from a nesting colony in E Washington, perhaps on Moses Lake (~135 miles east of the sighting area).²⁰⁶

The second theory seems possible, but neither one would be especially likely in terms of the statistical distributions: Southward winter migration from British Columbia spans early September to November; and spring breeders arrive back from the south from April to early May.²⁰⁷ And according to the Seattle Audubon Society neither migrants nor non-breeders have any noticeable presence in the Cascades at any time of year (Table 2). The nearest Washington ecoregion listed with a non-zero abundance is the low ground of the Puget Trough roughly following the interstate I-5 from the Sound down to Vancouver, and even here numbers are "rare" in all months of the year. Foraging breeders and non-breeders are "common" in June/July only in the Columbia Plateau ecoregion far to the east of the Cascades (see Fig 19). In the West Cascades they are not even rare.

206 Price, M., letter to the Editor, *Fortean Times*, April 2010

207 Campbell, R.W., et. al., *Birds of British Columbia*, Canadian Wildlife Service/U. of Brit. Col., 1990 p.208

ECOREGION	J	F	M	A	M	J	J	A	S	O	N	D
Oceanic	-	-	-	-	-	-	-	-	-	-	-	-
Pacific NW Coast	-	-	-	-	-	-	-	-	-	-	-	-
Puget Trough	R	R	R	R	R	R	R	R	R	R	R	R
North Cascades	-	-	-	-	-	-	-	-	-	-	-	-
West Cascades	-	-	-	-	-	-	-	-	-	-	-	-
East Cascades	-	-	-	-	-	-	-	-	-	-	-	-
Okanagan	-	-	-	-	-	R	R	R	R	U	U	R
Canadian Rockies	-	-	-	-	-	-	-	-	-	-	-	-
Blue Mountains	-	-	-	-	-	-	-	-	-	-	-	-
Columbia Plateau	U	U	U	F	F	C	C	C	C	C	U	U

Table 2. American White Pelican abundance in Washington State by ecoregion

C=Common; F=Fairly Common; U=Uncommon; R=Rare

Data from Seattle Audubon Society, http://www.birdweb.org/birdweb/bird_details.aspx?id=33

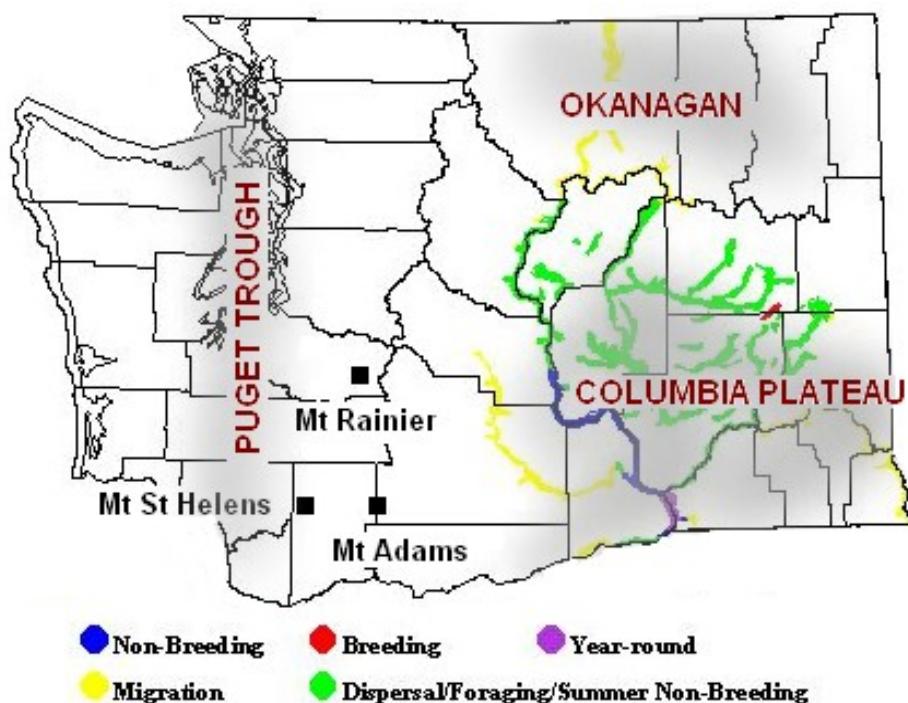


Fig.19 Range of American White Pelicans in Washington State
Adapted from http://www.birdweb.org/birdweb/bird_details.aspx?id=33

Let us consider the hypothesis quantitatively.

a) angular size and distance

In Section 8 we considered Arnold's estimates of object distance (23 miles), object size (100ft) and DC-4 distance (15 miles), together with his real-time angular measurements of the objects and the DC-4 using his Dzus cowling tool, and found that all are consistent (within about 15%) with a reasonable lower bound on resolution acuity of about 3 arcmin.

The outstretched head-to-tail length of adult American White Pelicans is in the range 1.3m - 1.7m²⁰⁸ or 1.4m - 1.8m²⁰⁹ (50" - 70") including a bright orange bill about 30cm long. But in flight the neck is contracted, and a typical length of 1.0m (39") has been used in academic studies of white pelican flight patterns²¹⁰ along with a maximum wingspan of approximately 2.74m (9.0ft).²¹¹ The exposed remiges or flight feathers fringing the trailing edges and tips of the spread wings are black, so the bright white plumage of the inner wings and back would constitute the basic visible shape of the bird (significantly narrower in span than the entire 2.74m, of course) seen from distance and somewhat above (see Fig.28). As Easton pointed out²¹² this shape certainly does have some resemblance to certain drawings and verbal descriptions made by Arnold (see Appendix 4).²¹³ Arnold reported being able to observe the objects' shapes "quite plainly". So how close would Arnold need to be in order to plainly see the white shapes of pelicans?

In order to satisfy the 3 arcmin resolution acuity limit necessary for any shape to be perceptible when crossing Arnold's course nearly perpendicularly in the angular vicinity of Mt Rainier²¹⁴ (though of course not the geographical vicinity), a 1.0m-long pelican would need to be no further away than about 0.7 mile from Arnold, say 0.5 mile to be comfortable. But in order to be conservative, and to take account of possible rotation of aspect (see below and Fig 22) let us double this figure and place a just-resolvable white pelican at 1.0 mile range on LOS A in Fig.18 (inset).²¹⁵

b) CallAir course scenarios

Here we consider in detail the 102-sec transit between the lines of sight (LOS) to Mt Rainier (*A*) and Mt Adams (*B*) for the 3 scenarios in Fig 18b with Arnold flying from an initial position at *x* to positions at *w*, *y* and *z*. At position *x*, a pelican is sighted along LOS *A* towards Mt Rainier. To favour the hypothesis and give the pelican a "head start" we generously double the just-resolvable 3 arcmin subtense of a pelican approximately 0.5mi away and allow a distance of 1.0 mile away at point *P1*. After 102 sec at the maximum radar-tracked white pelican airspeed of 37kt,²¹⁶ plus a 19kt wind (see Appendix 2),²¹⁷ it must lie on or within arc *P2*.

During the same interval Arnold's plane has travelled approximately 3.4 miles (100mph airspeed, ~120mph groundspeed). Fig.18, assuming an initial heading for Yakima (just a little south of due

208 http://en.wikipedia.org/wiki/American_White_Pelican

209 O'Malley, J. B. E. & Evans, R. M., 'Structure and Behaviour of White Pelican Formation Flocks' *Can. J. Zool.* 60, 1388-1396,(1982)

210 Hainsworth, F. R., Induced Drag Savings from Ground Effect and Formation Flight in Brown Pelicans, *J. exp. Biol.* 135, 431-444 431 (1988)

211 *Ibid.* A few birds may attain a wingspan of >3.0m (10ft)

212 Easton, J, Voyager Newsletter #13, privately circulated July 2000

213 Arnold's drawings of that shape - a spade-like or beetle-like flat, thin "disk", longer than wide - appear to illustrate definitively what he meant by the description "shaped like half a pie-pan with a convex triangle in the rear" (interview by journalist Ted Smith, KWRC radio, Pendleton, on June 26, 1947; see Appendix 4), however it can be interpreted differently in context with other descriptors to suggest a winglike, tail-less planform. Easton pointed out that "white pelicans . . . also have no tail, but instead have a 'small triangle' in the back".

214 "Very shortly they approached Mt Rainier and I observed their outline against the snow quite plainly . . . I am making a drawing to the best of my ability, which I am including, as to the shape I observed the objects to be as they passed the snow-covered ridges as well as Mt Rainier." Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/CUFOS files)

215 Actually, even this proximity is impracticable when considered in the context of the geometrical relationship required to time the same pelican over 80° of angle between Mt Rainier and Mt Adams. This imposes an *absolute lower limit* on initial range of ~1.2 miles for a CallAir cruise speed of 100mph, even neglecting the unrealistic values of angular size incurred in this limit. A lower bound of 3miles is realistic (see Section 10.iv.,d). However as usual we will prefer to err, for the moment, on the side of conservatism.

216 Alerstam T., Rosén M., Bäckman J., Ericson PGP, Hellgren O, 'Flight Speeds among Bird Species: Allometric and Phylogenetic Effects', PLoS (Public Library of Science) Biol 5(8) 2007

<http://www.plosbiology.org/article/info:doi/10.1371/journal.pbio.0050197>

217 Allowing it the full benefit of a recorded 300° wind although the two vectors do not simply add.

East from Mineral), shows 3 possible positions of the plane after 102 seconds. Each position assumes that Arnold initiated his turn (rotating the aircraft broadside to view the objects through his open side window) at a different moment. His narrative indicates that the most likely course is one similar to the line shown terminating at point *y*; but if this turn does not occur during the 102 sec timing then the linear distance *xy* would be longer and Arnold's plane would be further outside the ambit of arc *P*₂.

Scenario 1) Arnold flies on (turning his plane temporarily towards the south at some point in order to observe through the open left side window) and at the end of 102 sec his position is now at *y*, beyond arc *P*₂, and the pelican is falling behind the plane. It is impossible for the pelican to remain visible ahead and to the East of the plane along LOS *B* towards Mt Adams. (Scenario 1 seems the closest fit to Arnold's detailed 1947 AAF account)

Scenario 2) Once again, the pelican begins approximately 1 mile away at *P*₁. This time Arnold turns his plane southward immediately after marking the objects on LOS *A* and continues on this course for the whole 102 seconds. When he reaches point *z* the pelican has arrived somewhere on arc *P*₂. It is impossible for the pelican to remain visible ahead and to the East of the plane along LOS *B* towards Mt Adams.

Scenario 3) In this case Arnold's southward turn is made either before or after the timing run, thus the plane continues straight on its Yakima course for the whole 102 sec from point *x* to point *w*. This is in conflict with Arnold's account; but the southward travel of the plane is retarded as much as possible in relation to the southward motion of the pelican from some position on LOS *A* and thus favours the hypothesis. In order for the pelican to be at all ahead of the plane when the plane arrives at point *w* then the pelican's position is obviously limited absolutely on the west side by point *P*₄, and using the same maximum possible groundspeed we can therefore draw the shortest route connecting *P*₄ to a point on LOS *A* to prove that the initial point of the pelican track must have been no further west than point *P*₃. In other words, the pelican must have been a *minimum* of about 3.5 miles from initial aircraft position *x*, and little more than 0.5 arcmin long, ~6 times smaller than the minimum resolvable shape. Even then, the rate of closure is so rapid that almost as soon as the pelican grows to more than an unresolvable speck it would become an identifiable pelican right off the nose of the plane, upon which it would immediately fall back aft of the plane on the left (NE) at a relative speed of about -100mph. It is impossible for the pelican to remain visible ahead and to the East of the plane along LOS *B* towards Mt Adams.

In general, for any aircraft track like those in Fig.18b, at the reported cruise speed, there is no possible initial pelican position anywhere on LOS *A* from which the pelican flight radius - even assuming the 37kt record maximum airspeed for a white pelican - intersects any subsequent LOS like LOS *B* from the plane to Mt Adams. And in the sort of flap/glide flight regime claimed by Easton to be clearly described by Arnold²¹⁸ this limiting airspeed would be unlikely.²¹⁹ In other words, as demonstrated in more detail in Figs.20 & 21, the most favourable possible pelican vector cannot reproduce the sighting geometry for an aircraft heading to Yakima or on any course that takes the aircraft south of this heading.²²⁰

218 'They employ a distinctive flapping and gliding motion,' Easton pointed out, 'often sailing for long periods on their massive wings. . .this is such an obvious correlation.' (Voyager Newsletter #10, 08 Apr 2000)

219 Brown Pelican speeds have been directly measured (up to 1200m; 4000ft) at about 22kt in glide and at about 19kt in flap/glide. Equivalent figures for Great Whites (similar to American Whites) are about 35kt (60-70km/hr) and 20kt (30-40km/hr) respectively. (See: Shannon, H.D., 'American White Pelican Soaring Flight Times & Altitudes', *The Condor* 104:679–683, 2002; Nelson, J.B., *Pelicans, Cormorants & their Relatives*, OUP. 2005)

220 Note that the hypothesis of a 1 min timing error attempted in Section 9 significantly reduces the angular speed and allows pelicans to fly ~1.6 times as far, expanding the circles of constant time in Figs. 20 & 21. But this is no help, because Arnold's own plane will also have flown 1.6 times as far during the same interval at almost twice the airspeed, and for each increment of duration the mismatch actually worsens.

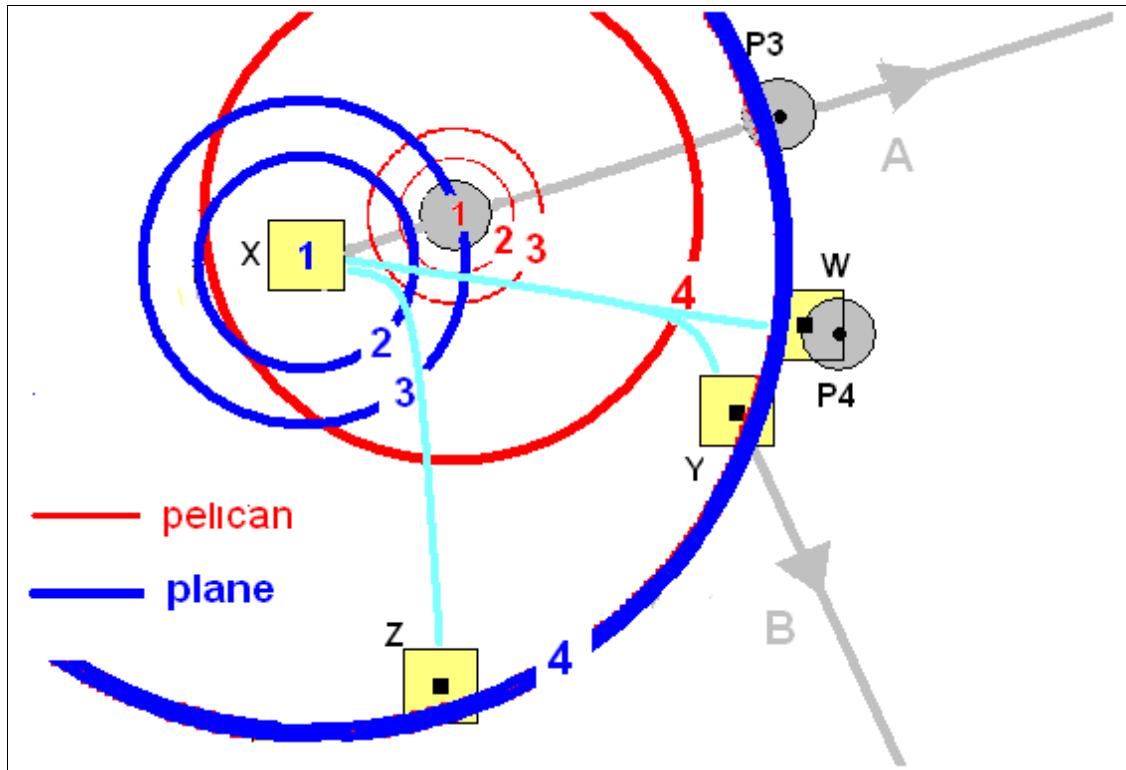


Fig.20 Circles of equal time (arbitrary units) expanding from initial positions of Arnold's plane (blue #1) and from a hypothetical pelican on LOS A at a range of 1 mile (red).

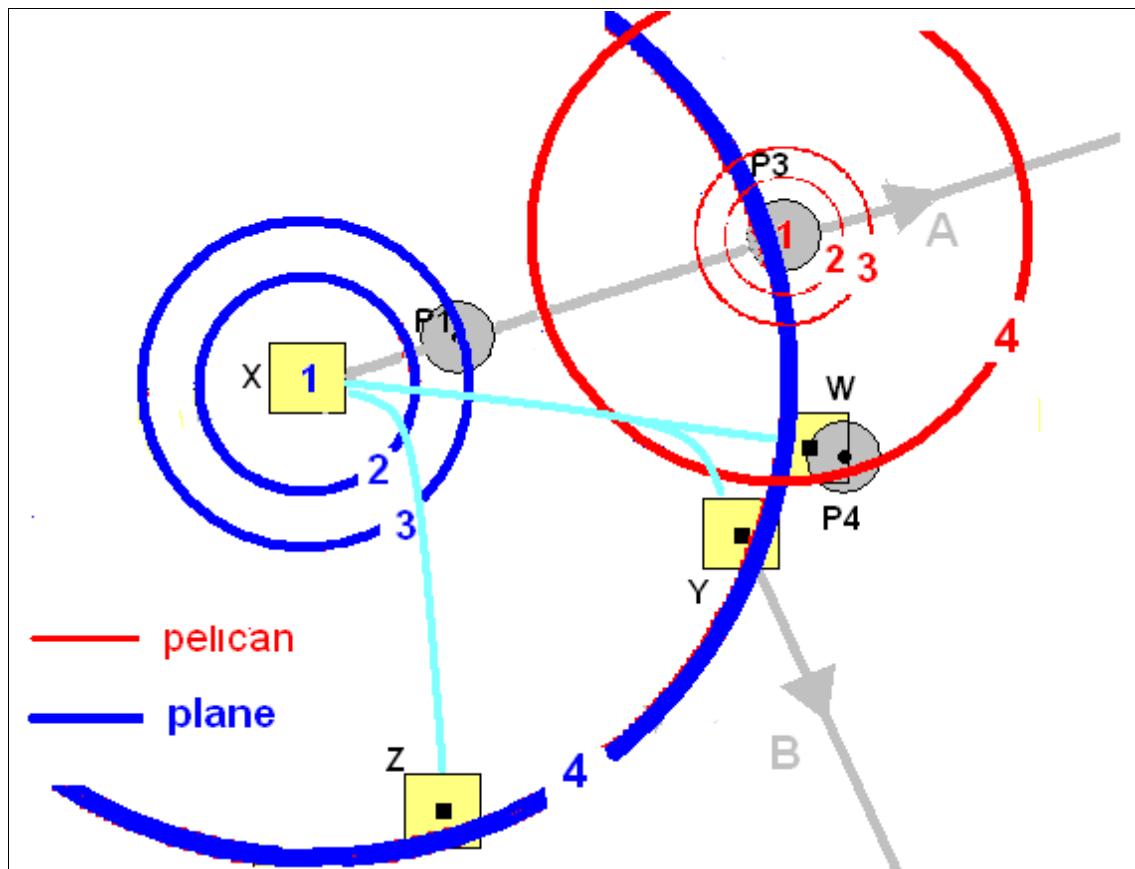


Fig.21 Sliding the red (pelican) origin along LOS A to a range of 3 miles at point P3.
See also Fig.22

Easton apparently did not publish a geometrical analysis, but countered qualitative criticism in a merely qualitative way by pointing out that this is sensitive to Arnold's exact flightpath, and that there are too many uncertainties in the record to be sure of it:

It has become clear there are discrepancies and inconsistencies in Arnold's various accounts, which is perhaps only to be expected and especially over time.

One major question is where and when Arnold first observed the objects. According to the testimony frequently cited, his letter to the Air Force, he was heading on a course towards Yakima and had been for "two or three minutes". It has sometimes been mistakenly assumed he was on route to Yakima, which was his ultimate destination, however, at this time Arnold was still engaged on a search for the missing C-46 transporter and confirmed he continued with that search after his sighting.

Alternatively, in his book, Arnold claims the incident occurred, "during this search and while making a turn of 180 degrees over Mineral, Washington, at approximately 9200 feet altitude" and in his much later 1977, 'UFO Symposium' speech, reiterated the sighting began when "I made a turn at probably 2000ft over Mineral, Washington and started climbing back slowly but steadily, climbing to gain sufficient altitude to go back on the high plateau again for another pass at this mountain. As I was making this turn and of course flying directly toward Mt. Rainier, at about 9200 ft elevation..."

So, was he, for some reason, heading slightly south of east towards Yakima and had been for 2-3 minutes, or was he heading north-east from Mineral towards Mt. Rainier, continuing his search?²²¹

Easton is correct that answers to these questions make a significant difference to the pelican hypothesis. We have shown (Figs.18, 20 & 21) that over a certain range the uncertainty is not material, because it is geometrically impossible for courses with any southerly component to have allowed pelicans to remain in transit over the 80° of angle between Rainier and Adams for 102 sec. But the calculation changes if he was *not flying on any one of the class of headings illustrated* in Fig.18, specifically if he was flying approximately ENE towards the peak of Mt Rainier.

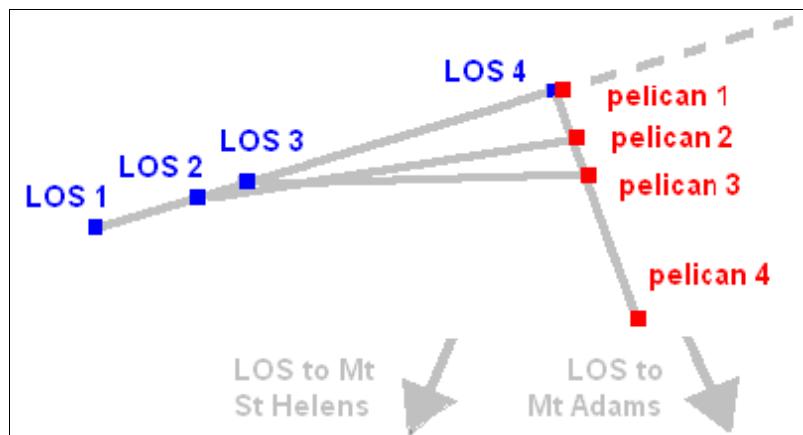


Fig.22. Geometry of a possible pelican sighting fulfilling the reported angular relationship requirements, showing 4 lines of sight from a CallAir travelling ENE towards Mt Rainier

²²¹ Easton, J, UpDates email list post 22 Apr 2000

Easton is also correct that there is another significant uncertainty, in Arnold's report that he turned his plane during the sighting so that he was oriented "sideways" to the objects and could observe them without obstruction through an open side window:

It depends on how Arnold flew relative to those nine objects at all times and, crucially, what his individual perceptions were. An important unknown is exactly what Arnold meant when he confirmed turning his airplane "around" during the brief episode.²²²

Indeed. Which direction did Arnold turn? When? How far? And for how long?

These issues are interconnected. An initial heading south of due East in the direction of Yakima would in turn tend to make it natural for Arnold to have turned his plane to the right (south) in order to place himself "side on" to the SSE-heading objects for the purpose of viewing them through the opened left side window. But it is true that nowhere is Arnold perfectly explicit about the direction of this turn, and Easton argues that if Arnold was still engaged on a search for the missing marine C-46 (and he did return to this task for a while after the sighting) then he was probably heading back ENE straight towards Mt Rainier at the time, not towards Yakima, in which case it may have been more natural for him to turn his plane to the *left* - i.e., pointing somewhat north of Mt Rainier - in order to view the southbound objects through the *right* side window. If so, then for at least part of the 102 seconds of the timing run Arnold may have been flying approximately NE, not SE.

Thus we have our final scenario:

Scenario 4) If Arnold's course was towards Mt Rainier approximately along the initial LOS A in Fig.18 then a pelican starting from a position on that LOS near P3 (Fig 18, inset) and flying SSE at maximum speed could remain visible to the right of the aircraft, with the relative bearing rotating southwards as the plane flies, reaching a bearing near Mt Adams after 102 sec. The geometry of this scenario with the LOS rotating from 1 through 4 is shown in Fig 22.

Unfortunately this promising hypothesis is spoiled by several considerations

Firstly, Easton acknowledges that "discrepancies and inconsistencies [are] only to be expected and especially over time"²²³ but then somewhat perversely places considerable weight on a sentence published by Arnold 5 years after the sighting in 1952, and another account 25 years later still, in which he recalled that he first saw the objects "as I was making this turn [the initial 180 over Mineral] *and of course flying directly toward Mt. Rainier* [emphasis added]". This is to a certain extent self-inconsistent as well as inconsistent with his own explicit statement 30 years earlier (see also discussion in Section 3).

In his earliest detailed Army Air Force report, Arnold said that after searching all the ridges on the west plateau of Rainier he came west down the canyon, turned over Mineral, climbed to 9200 ft then "trimmed out my airplane *in the direction of Yakima* [emphasis added]" and simply sat back in my airplane observing the sky and the terrain" (see Section 3). It was after two to three minutes on this course, he said, that he first saw the objects.²²⁴ Which rather strongly suggests that he had settled into a cruise for Yakima. In view of differing impressions created by accounts in later years there may be some doubt that this statement, whilst explicit, is sufficient. Nevertheless a course somewhat to the south of east, rather than north of east, is consistent with other primary statements and circumstances.

222 *Ibid.*

223 *Ibid.*

224 Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/UFOS files)

One circumstance of arguable significance is the location of the 5-mile ridge identified by Arnold as Goat Ridge (or Goat Rocks, see Section 7) which is considerably south of Mt Rainier. Arnold said he happened to be "flying in the direction of this particular ridge" and so it was convenient to check its dimensions, and thereby the length of the chain of objects, by flying the length of the ridge. In itself this does not prove that he was heading south of Mt Rainier *during* the sighting - he could have been describing a diversion to measure the ridge *after* he had returned to search Mt Rainier and whilst on his way to Yakima, which appears to be Easton's favoured interpretation. But this would seem psychologically inconsistent. Arnold tells us that he gave up searching because he was preoccupied with what he had seen and (lacking radio) was eager to land and tell somebody about it. He therefore flew straight to Yakima, "after a last look at the Tieton Reservoir", 30 miles from Mt. Rainier. If he was quitting a search on Mt.Rainier to go to Yakima *via* Tieton, why would he then have diverted south in order to measure the 5-mile ridge?²²⁵ On the other hand there is nothing that requires his continued search to have been made exclusively (or even at all) on Mt Rainier. The most consistent interpretation (see Section 7) is that he had already measured the 5-mile ridge at the end of the sighting itself and *before* or *as part of* his resumed search of the Cascades (but not of Mt Rainier proper) because he happened to have been "flying in the direction of this particular ridge" (ESE or SE) when the objects disappeared beyond Mt Adams.²²⁶

Another small and rather curious clue comes from an early article in the Chicago *Tribune* quoting and summarising an interview with Arnold:

He said he encountered the mysterious objects while he was north of Mt. Rainier, headed southeast. He said he was flying at 9200 feet altitude and that the objects, an estimated 25 miles away from him when he first saw them, were traveling due south.²²⁷

This article (see also Section 4) is notable for containing several confusions, one of which appears to have warped the sense of this paragraph slightly. The first sentence might, on its own, be interpreted to mean that Arnold said the *objects* were "headed southeast", which as a rough-and-ready indication might not be unacceptably far (about 35°) from the 170° heading Arnold specified elsewhere.²²⁸ But, plainly, Arnold did *not* tell the Tribune that "*he* was north of Mt Rainier" when he encountered the objects; we know he was WSW of Mt Rainier. Rather, he must have said that the *objects* were initially north of Mt Rainier. That the objects appeared to be "travelling due south" is (approximately) accurate, establishing the correct object-heading from north to south and thereby resolving the ambiguity of the phrase "headed southeast" in the first sentence, which evidently was *not* offered as a rough indication of object heading since the phrase "travelling due south" fills that function. Therefore, given that this direction came from somewhere, the simplest explanation is that Arnold told the befuddled *Tribune* that *he* was "headed southeast".

225 Especially if the ridge was indeed at or "near"Goat Rocks , as Arnold believed. The argument is weakened, but not completely invalidated, if the massif concerned was really the much closer Tatoosh Range (see Section 7).

226 As pointed out in Section 7, in no source, early or late, does Arnold specify that his briefly "continued search" was over Mt Rainier. In the 1977 account appealed to by Easton to ratify his ENE course scenario, Arnold does not mention returning to his search for the missing plane at all, and implies that when the objects disappeared "I sort of lost interest in my search mission and I decided that maybe I ought to go to Yakima and report it . . . I just kept flying on the way they had traveled across the Cascade range and on to Yakima." [emphasis added]. This would fit a scenario which has Arnold measuring the 5-mile ridge whilst *en route* to land at Yakima. In this case one would have to assume that when Arnold originally said he "continued with the search" he had meant a search of the Cascades on his route south of Mt Rainier, including specifically the Tieton Reservoir area, also *en route*, and not a return to the Mt Rainier canyons. On this interpretation the statement "I just kept flying on the way they had traveled" would imply that he had been heading south of due east during the clocking of the objects, and carried on over the 5-mile ridge because "I was flying in the direction of this particular ridge".

227 Chicago *Daily Tribune*, June 26 1947, p.1 (NICAP/CUFOS files)

228 In another place, on the same day as the *Tribune* article, Arnold even says they were heading "about 160 degrees south", but this is evidently a sport (interview by journalist Ted Smith, KWRC radio, Pendleton, on June 26, 1947).

This inference would appear to be reinforced a little later in the same article where it states: "Arnold said his observations were made while he was flying at about 115 miles an hour *on an almost parallel course, and they 'went by me like a rifle bullet.'* [emphasis added]" The clear meaning here is that he was flying a heading significantly south of due east.

Finally, in his broadcast interview on radio KWRC that same afternoon Arnold joked to interviewer Ted Smith: "They were just simply flying straight and level and I, ha ha, I laughed and I told the fellows at Pendleton, they sure must have had a tailwind. But it didn't seem to help me much."²²⁹ This clearly implies Arnold's understanding that he and the objects were flying approximately on the same heading and were subject to the same tail wind, thus he must have been flying roughly SE.



Fig. 23. CallAir A-2.²³⁰ Rearward visibility from the left-hand pilot's position (shown here) through the *right*-hand rear plexiglass window is obviously restricted

A final group of arguments in relation to the aircraft track, and a rather strong one, begins with the two facts *a)* that Arnold deliberately intended to clock the objects between Mt Rainier in the north and Mt Adams or Mt St Helens in the south, and *b)* that he rotated the aircraft at this time to view them through an open cockpit window. As Easton argued, what Arnold meant by the statement that he turned his plane "sideways" to do this is "an important unknown".²³¹ Which way did he turn, how far, how long and from what original heading?

If Arnold was on the reported Yakima or "southeast" heading then it would be natural and probably entirely instinctive to turn *right*, following the path of the objects "on an almost parallel course" as Arnold was quoted as saying, and placing them in the open left side window. A right turn to the south will keep the apparently fast-moving southbound objects in plain view if and when they move ahead of the plane. Also I am grateful to Canadian pilot and author Don Ledger for pointing out²³² that, in addition, turning right in these circumstances requires much the smaller rudder angle and Arnold would have turned mainly on the rudder with minimum aileron input in order to keep the high-dihedral wingtip down out of the line of sight; whereas not only would a more acute left turn be unnatural it would make it more difficult to prevent the wing coming up. But as previously shown, if Arnold was on this Yakima or "southeast" heading then we can prove (Figs.18, 20, 21 and box) that if he turned *right* in this way, or even if he did not turn at all, the pelican hypothesis fails.

229 Broadcast radio interview with Ted Smith, KWRC Pendleton, June 26 1947.

230 Kilber, R., 'A Wing, a Prayer and a CallAir' *Custom Planes Magazine*, August 1999 p.28.

<http://ronkilber.tripod.com/callair/callair.htm>

231 Easton, J, UpDates email list post 22 Apr 2000

232 Email to the author from Don Ledger 01.04.2010



Fig.24 Photographs of Arnold at the left-hand door of his CallAir²³³

If Arnold was already on the ENE heading favoured by Easton, "directly towards Mt Rainier", a turn to the right is even more incompatible with the possibility of timing the pelicans through 80° as far as Mt Adams in 102 sec; but a turn still further to the *left* or north does now become a natural option, and pointing the nose to the north of Mt Rainier would allow him to observe the southbound objects through the open *right* side window. If Arnold turned northward from a heading along LOS A for most of the 102 seconds, thus rotating his plane "sideways" to the objects whilst their shapes could still be discerned "quite plainly" (that is before they dwindled below resolvability in the angular vicinity of Mt Adams) then the pelican scenario of Fig 22 remains possible.

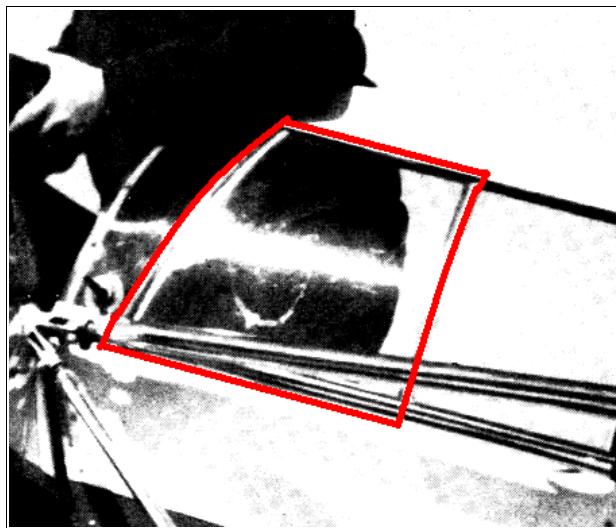


Fig.25 Arnold's left-hand cockpit window. The window opens by the outlined section sliding backwards, so that the aperture is *forward* of the pilot's position in a normal seated posture (see Fig..26)

But this hardly makes sense in terms of Arnold's deliberate intention to clock the speed. He pointed out that "I didn't know where their destination was, but . . . I had Mt. Saint Helens and Mt. Adams to clock them by" and with these two prominent markers available in the south he was "in a

233 Note different paint livery. It appears that Arnold replaced NC33355 probably around 1950. See note 22.

beautiful position to do it".²³⁴ But if he was headed towards Mt Rainier along LOS A then Mt Adams and Mt St Helens were already 70° and 120° respectively to his right. With Mt St Helens already 30° behind his right shoulder, turning any further towards the N (even without turning fully "sideways" to the objects' apparent flightpath) would make these southerly timing markers awkward to observe, and having to crane his neck would make the exercise of timing them by his instrument clock unnecessarily impractical.²³⁵

This disadvantage of heading NE would be an issue even if Arnold's cockpit visibility was unobstructed through 360°, but it was not. Even if Arnold had been happy to keep viewing the objects through the plexiglass²³⁶ rather than in the open window, his southern timing markers would remain visible comfortably only at an angle through the narrowing rear section of the window on the *opposite* side of the cockpit from the pilot's seat (which is universally the left seat²³⁷ and was so for Arnold, as shown in photographs of him entering or leaving the plane *via* the left door; see Fig 24). But the angular field of view through an open right-hand window for an observer in the pilot's position would not only be dramatically reduced in width (to not much more than about 10° for a ~30cm aperture ~150cm from the eye) it would also be restricted to a ~10° pencil of bearings ahead of the right wing because of the forward position of the window aperture (Figs 25 & 26).²³⁸ If Arnold turned the plane at all to the left then objects approaching Mt Adams at 70° off the nose would certainly be lost from the FOV of the open window. All in all, this is hardly a "beautiful position" for observing and timing the southbound objects.



Fig.26 The CallAir pilot position in relation to the opening side window pane (outlined in yellow)²³⁹

Is there nevertheless some overriding reason why Arnold would have chosen to turn his plane towards the direction from which the objects had come, rather than towards the direction he believed they were heading? Assuming he is himself already on an ENE heading, one mitigation is that a left turn now becomes the smaller rudder angle, making it easier to minimise the aileron use and keep the wing down during the turn, which would at least minimise the length of any obstruction of his view by the wing. But the whole point of turning the aircraft at all was to bring

234 Broadcast interview of Kenneth Arnold by journalist Ted Smith, KWRC radio, Pendleton, on June 26, 1947.

235 Arnold acknowledged an inevitable small lag due to "breaking his gaze" from the objects to his clock, but arguably this does not imply craning his neck or twisting around in his seat.

236 Arnold said that the sun "seemed to hit the tops of these peculiar looking things in such a way that it almost blinded you when you looked at them through your plexiglass windshield", suggesting scattering in the plexiglass due to internal reflection, imperfect transparency, abrasions etc. (Broadcast interview of Kenneth Arnold by journalist Ted Smith, KWRC radio, Pendleton, on June 26, 1947.)

237 Email to the author from Don Ledger 01.04.2010

238 The forward position of the open window is a deliberate design to minimise rain entering the cockpit and to facilitate voice communication during start-up between the pilot and a person hand-proping the engine. (Email to the author from Don Ledger 01.04.2010)

239 Kilber, R., 'A Wing, a Prayer and a CallAir,' *Custom Planes Magazine*, August 1999 p.28.

<http://ronkilber.tripod.com/callair/callair.htm>

the objects into view through the open side window, and the choice of a left turn is itself guaranteed to significantly curtail the length of unobstructed viewing because of the very restricted field of view offered by the openable half of the window on the far side of the cockpit, so this would seem a very unnatural choice.

In summary, we have shown that it is *possible* to find a NE course for Arnold's CallAir from which the measured angular transit of ~80° from Mt Rainier to Mt Adams in 102 seconds (and this property alone, neglecting angular size relationships; see 10.iv.d.) could be satisfied, in principle, by a flight of pelicans. Such an anti-parallel course is explicitly ruled out by one published statement attributed to Arnold (but of uncertain reliability; Chic.*Tribune*, June 26 1947). It is implicitly ruled out (but strongly) by Arnold's broadcast radio statement regarding "tailwind" on the same day. There is also secondary and circumstantial evidence against it and, more importantly, we can show that the realistic conditions of flying and observing in a CallAir make it very unlikely that Arnold would have chosen to follow such a course.

c.) pelican flight formation

American White Pelicans, like other large flocking birds such as Canada geese, often fly in regular formations. The reason has been determined to be, at least in part, a question of exploiting wing-tip vortices to reduce drag. The vortices shed behind the wing represent energy lost to the bird as a cost of flying, and if it can be partially recovered by the next bird the overall cost can be lowered and collective flying efficiency improved by a factor variously estimated at between a few percent and a few tens of percent based on aerodynamic theory.²⁴⁰ Savings of up to 70% have been claimed.²⁴¹ Evidence of the efficacy of this tactic has been found in lowered heart rate and wing flapping frequency in trained white pelicans flying in formation versus singly.²⁴² And the nearer to the rear of a formation a bird is positioned the lower its wingbeat rate and flapping duration are found to be.²⁴³

The resemblance of the chain of objects to a formation of flocking birds flying in trail, stepped to one side behind the leader in an echelon pattern, is at first sight perhaps the strongest single point in favour of pelicans. This is strongly reinforced by Arnold's own 1947 simile: That the objects flew in a diagonal formation somewhat like a skein of geese. This similarity is strongly emphasised by Kottmeyer and Easton, the latter concluding that Arnold's description was "at least amazingly similar" to a formation of American White Pelicans. A simile offered by Arnold himself can hardly be argued with; but, quantitatively considered, the resemblance becomes less compelling.

flapping and gliding patterns: Arnold described the motion of the objects using various images - speedboats on rough water; fish flipping in the sun, etc. - and said that each object had a generally level undulating flight punctuated at random by a sudden jerking, tipping or flipping movement when it flashed in the sun like a mirror. Easton argued that this is a perfect match to the flap/glide flight pattern of pelicans, which he characterised as long glides punctuated by occasional periods of flapping - "a distinctive flapping and gliding motion, often sailing for long periods on their massive wings"²⁴⁴ or "a long, motionless gliding action, interspersed with 'flapping.'"²⁴⁵ So the sudden "tipping" or "flipping" motions would be bursts of flapping to gain altitude for the next long glide.

240 Lebar Bajec, I. & Heppner, F. H., 'Organized flight in birds' *Animal Behaviour*, 78(4), 777–789. (2009).

241 Thien, H.P., Moelyadi, M.A., and Muhammad, H., 'Effects of Leader's Position and Shape on Aerodynamic Performances of V Flight Formation' ICIUS 2007. <http://arxiv.org/ftp/arxiv/papers/0804/0804.3879.pdf>

242 Weimerskirch, H., Martin, J., Clerquin, Y., Alexandre, P. & Jiraskova, S. 2001. 'Energy saving in flight formation.' *Nature*, 413(6857), 697–698.

243 O'Malley, J. B. E. & Evans, R.M., Structure and Behaviour of White Pelican Formation Flocks', *Canadian Journal of Zoology*. 60, 1388-1396 (1982).

244 Easton, J., *Voyager Newsletter* no. 10, privately circulated, April 07 2000

245 Easton, J., UFO UpDates mailing list, 22 July 1999

In fact the flap/glide ratio in American White Pelican formations is the reverse of this pattern. The relative durations of wingbeat episodes (average beat frequency ~166/min) and glide episodes have been measured - with no significant difference being found between different shapes of flock - to be in the ratio 70% to 30%,²⁴⁶ in other words long periods of flapping interspersed with shorter periods of gliding.²⁴⁷ During the 2.5-3 mins of the sighting Arnold would be expected to witness on average 105-126 sec of flapping, and only 45-54 sec of gliding.

A coupled issue is the synchrony of flapping in pelican formations. As mentioned above, in order to exploit vortex positioning for its drag-reduction advantage the wing period of a trailing bird must be synchronised in phase with the bird in front.²⁴⁸ This leads to coordination of wing motion through the whole flock on a very short timescale. The characteristic time for the flight mode shift in echelon formations was found to be about 0.5sec from bird to bird, so that in addition to synchronisation of wingbeat phase between birds during flap mode, repeated synchronised shifts from flap to glide would be expected, each shift (usually initiated by the lead bird) propagating through a flock of 9 birds in approximately 4 sec.²⁴⁹

Arnold's description does not suggest coordinated, global changes of flight mode of this type but rather indicates sporadic and independent motions, e.g., "two or three of them every few seconds would dip or change their course slightly, just enough for the sun to strike them at an angle that reflected on my plane",²⁵⁰ and "I made a special note, they were all independent. Individually they were flying on their own, but every once in a while one of them would give off a flash like this and gain a little more altitude or deviate just a little bit . . . not in a regular rhythm particularly."²⁵¹

interbird separation: In one study²⁵² using data obtained from 28 filmed formations of American White Pelicans²⁵³ the horizontal wing tip separation (WTS) roughly matched the theoretical spacing required for increased efficiency based on vortex positioning (although not as closely as for Canada geese). The WTS of American Whites was found to be more constant than that of brown pelicans (which do not appear to value the aerodynamic advantage and show little tendency to cluster around a favoured WTS). For the Whites, whilst it is not necessarily the case that formations filmed from the ground will behave in the same way as formations encountered at 9,000ft, the results do appear to have some generality, inasmuch as no significant difference was measured in average WTS for birds flying in or out of ground effect (i.e., close to a water surface or at higher altitude), and no significant difference in WTS was measured whether the birds were flapping or gliding. (No significant difference was found, either, in vertical spacing whether flapping or gliding, although this parameter was measured only for brown pelicans).

Using the simple aerodynamic formula $\frac{1}{4}\pi b$, where b = total wingspan, the same study finds a trailing vortex located at each of the two values of $\frac{1}{2}(b - \frac{1}{4}\pi b)$ inboard of the wing tips. For a

246 O'Malley, J. B. E. & Evans, R.M., 'Structure and Behaviour of White Pelican Formation Flocks', Canadian Journal of Zoology. 60, 1388-1396 (1982).

247 Longer gliding phases may be associated with thermal soaring, which is a quite different type of flying from that suggested here. See: Shannon, H.D., et. al., 'American White Pelican Soaring Flight Times & Altitudes' *The Condor* 104:679-683 2002.

248 Hainsworth, F.R., 'Induced Drag Savings from Ground Effect and Formation Flight in Brown Pelicans', *Journal of Experimental Biology*. 135, 431-444 (1988) 431.

249 O'Malley, J. B. E. & Evans, R.M., Structure and Behaviour of White Pelican Formation Flocks', Canadian Journal of Zoology. 60, 1388-1396 (1982).

250 Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947

251 Arnold, K., "How It All Began" in Fuller, Curtis G., *Proceedings of the First International UFO Congress* [1977], Warner, 1980, pp. 17-29

252 Hainsworth, F.R., 'Induced Drag Savings from Ground Effect and Formation Flight in Brown Pelicans', *Journal of Experimental Biology*. 135, 431-444 (1988) 431.

253 O'Malley, J. B. E. & Evans, R.M., Structure and Behaviour of White Pelican Formation Flocks', *Canadian Journal of Zoology*. 60, 1388-1396 (1982).

typical span of 274cm this occurs at approximately -30cm, predicting that American White Pelicans forming to minimise induced drag will converge on a horizontal WTS of about this figure, which represents (for a right-echelon formation) a small overlap in the lateral spacing between the right wingtip of a lead bird and the left wingtip of a trailing bird. The measured distribution of WTS in white pelican formations was found to peak in the range 0 to -1.0m in conformity with this prediction (see Fig.27). According to Hainsworth, "The frequency distribution for formation average WTS shows the positive skew expected if birds were to cluster near a particular position (such as -30 cm if $b = 274$ cm) and to avoid extreme overlap of WTS. Although much information is lost in averaging over entire formations, it appears that in some formations white pelicans may have maintained WTS close to values yielding relatively high savings in induced drag."²⁵⁴

Most notably for our purpose, nearly 90% of measured formations exhibited average lateral WTS of +1.0m or less; only one out of 28 formations exhibited an average WTS as large as +3m. Another way of expressing these figures is in terms of the lateral centre-to-centre interbird distance, which has a strong mode around one wingspan, close to the theoretical vortex-positioning distance of about 2.4m.

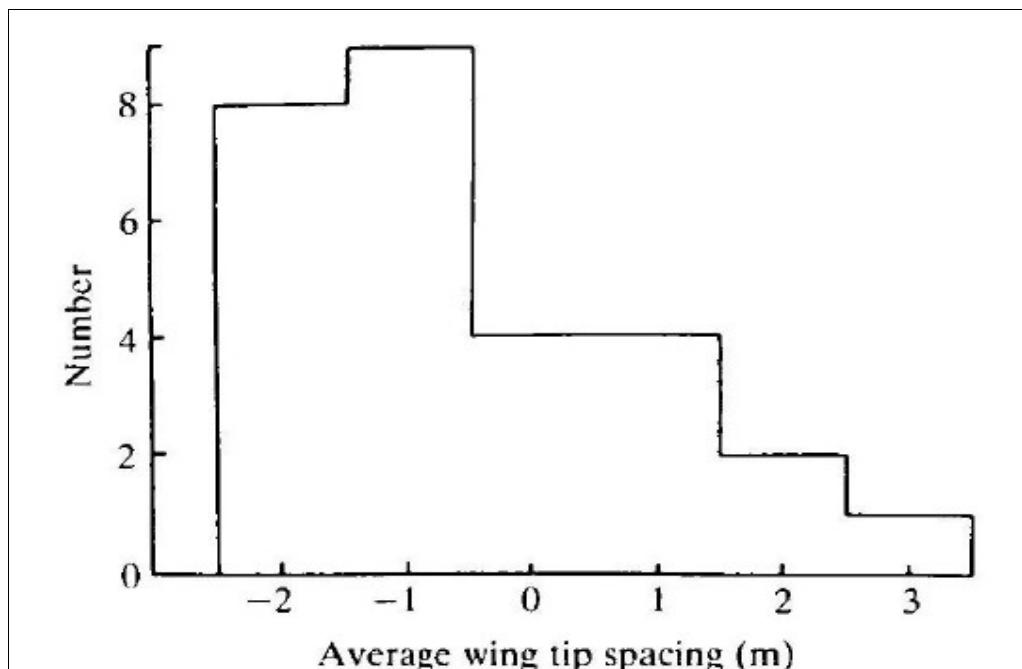


Fig.27 Frequency distribution of average wing tip spacing for 28 formations of white pelicans (from Hainsworth, 1988)

Another measure of separation is the interbird distance measured diagonally along the arm of the formation. In 28 cases the centre-to-centre diagonal distance ranged from 1.3 to 6.2 bird lengths. (This diagonal distance was strongly positively correlated with the angle of the formation, which in V and J formations means the internal angle of the two arms. That is, the more acute the angle of the diagonal with respect to the flight direction, the smaller the interbird distance.) Assuming the previously cited 1.0m mean in-flight bird length, the mean diagonal distance between bird centres is ~3.0m.²⁵⁵

254 Hainsworth, F.R., 'Induced Drag Savings from Ground Effect and Formation Flight in Brown Pelicans', *Journal of Experimental Biology*. 135, 431-444 (1988) 431.

255 O'Malley, J. B. E. & Evans, R.M., Structure and Behaviour of White Pelican Formation Flocks', *Canadian Journal of Zoology*. 60, 1388-1396 (1982).

As a leading bird's wings flap the vortex position traces a sinusoidal variation in vertical position behind them, and to use the uplift the wingbeat of the trailing bird needs to be in phase.²⁵⁶ This means that for most efficient exploitation of vortex position each trailing bird must not only have a matching wingbeat frequency but needs to position itself one wingbeat period behind the bird in front. One wingbeat period, at the mean beat frequency of American White Pelicans in echelon formation (168 beats/min; 2.8 beats/sec),²⁵⁷ and flying at their record maximum speed, would be equivalent to a maximum of ~6m of horizontal travel. A mean speed closer to half of the maximum seems a plausible ballpark and would suggest a typical trailing distance of no more than a few bird-lengths consistent with many formation photographs (see Fig.28).



Fig. 28. Typical white pelican formations.

A number of internet videos are available illustrating flapping/gliding behaviour, e.g.

<http://www.youtube.com/watch?v=Q8ePoy90VU0&feature=related>

The vertical depth of American White Pelican formations was not measurable from films in these studies but for efficient use of vortex positioning the variation in depth can be only of a similar order. Bird echelons in all studies appear to be treated as approximately flat left- or right-echelons.²⁵⁸ Direct measurements of trailing distance are not available either, but as a rough guide

256 Hainsworth, F.R., 'Induced Drag Savings from Ground Effect and Formation Flight in Brown Pelicans', *Journal of Experimental Biology*, 135, 431-444 (1988) 431.

257 O'Malley, J. B. E. & Evans, R.M., 'Structure and Behaviour of White Pelican Formation Flocks', *Canadian Journal of Zoology*, 60, 1388-1396 (1982).

258 For a simple fixed wing, 'The formation flight achieves the maximum drag reduction value when the aircraft are on the same horizontal plane, namely no separation in vertical direction'. (Thien, H.P., Moelyadi, M.A., and H. Muhammad, 'Effects of Leader's Position and Shape on Aerodynamic Performances of V Flight Formation', *ICIUS 2007*, Oct 24-25, 2007 Bali, Indonesia.) One might think that the trailing vortex ought to be shed, on average (averaged over a sinusoidal path tracking the wingbeat amplitude), somewhat downward from the leading wing, carrying some momentum opposite in sign to the upward lift. But one would expect a vertical spacing no larger than the vertical travel

we can note that the above figures for mean lateral and diagonal interbird distances imply a mean trailing distance of $2.4[\tan(\cos 2.4/3 \text{ degrees})] = 1.75\text{m}$, or a couple of bird lengths, which would appear broadly consistent with many photographs of white pelicans in formation flight.

In summary, the characteristic interbird distances in echelon American White Pelican formations can be expected to be in the order of only a few metres on all dimensions. That is not to say that unusual large separations won't occur. The birds do also fly in random or "thermal" clusters, as well as singly and far apart, when no characteristic distance can be defined. But birds that *are* forming in cross-country flight do so principally because of the aerodynamic advantage conferred and therefore do so under the constraints described above.

So what can be inferred from this? If we calculate the approximate total angular length of a 9-pelican echelon formation, allowing 1m per bird plus eight (say) 3m spacings, we get $\sim 33\text{m}$, which at 3 miles (4.8km) subtends only about 20 arcmin (0.3°), or about 5mm at arm's length. Clearly this is too small by an enormous factor, and the individual birds would be barely discernible. The angular length of the formation observed by Arnold, measured against a 5-mile mountain ridge at a distance of 20 to 30 miles (depending on identity; see Section 7), is in the range 10° to 15° (consistently drawn by Arnold in correct scale with the ridge and with the angular width of Mt Rainier; see Section 4 and Section 6, Fig.10a) tending towards the upper figure. This implies proportionally an overall formation length at the minimum geometrically feasible pelican range of 3 miles (see Section 10.iv.d below) of 1270m (0.8 mile) and a trailing separation between individual birds approaching 60m (200ft), which is several tens of times the observed and theoretical mean separation in pelican formations.

To approximately visualise this: Each 1.0m-long pelican would be a relatively tiny speck, subtending between 1/300 and 1/200 the angular length of the chain. If this figure

.....

represents a typical in-trail separation of the order of scale shown in Fig.28, then this figure

.....

represents the spacing of a line of pelicans subtending the angular length measured by Arnold. There is no utility to pelicans forming like this, with a trailing separation in the order of ten times the wingbeat phase, and an echelon angle (obviously not shown here) equating to a proportionately huge lateral wing tip separation of tens of metres.²⁵⁹ There is no possibility of aerodynamic advantage.

In summary, the claimed "obvious correlation" and "amazing similarity" to typical pelican formation flight patterns do not stand up so well to scrutiny. It remains possible to argue similarity to an *atypical* pelican formation, but this was not the case presented, and an argument based on similarity to atypical behaviour must be regarded as statistically weaker.

of the trailing vortex during one wingbeat period, and the fall proportional to only a few metres horizontal travel cannot be large.

259 The objects were evidently at a *slight* depression angle a degree or two below Arnold's astronomical horizon, therefore up to 2000ft lower than he believed depending on true range (see Section 4). The perspective projection of a *very oblique* flat right-echelon formation, even if seen from only $\sim 2^\circ$ above, might give the impression of a formation stepped down behind the leader - which is what Arnold perceived - rather than stepped laterally. But the true lateral spacing would be proportionately large. Of course if they were larger and more distant objects some of which passed behind the peak of Glacier Island, which Arnold also reported, then the topography tends to dictate that there must indeed have been a significant true spread in altitude.

d.) geometrical limits on range and variation of angular size

With regard to the above problem of very large interbird separation, we could try bringing the birds somewhat closer to Arnold, which would increase individual true size and angular size in relation to the chain. But obviously one doesn't wish to go too far because the birds become clearly identifiable. In fact to get object separation and object length in a realistic ratio of about 3:1 each bird occupies about 1/33 of the 10°-15° measured total subtense, or 20-30arcmin. The pelicans are then only about 140m away from Arnold's plane and each single bird's body appears nearly as large as the full moon.

And long before reaching this point we drive beyond acceptability another inconsistency, in the direction of change of object angular size. If we skew Fig 22 by sliding P1 closer to Arnold on LOS 1, we find that to keep P4 on the Mt Adams LOS means shortening the range from the plane to P4. The effect of this is to increase an angular enlargement factor which is *already a problem with the birds at 3 miles*, as follows:

When the plane reaches LOS 4, Arnold sees what he interprets as distant objects dwindling at more than twice the range they first appeared to be when initially seen on LOS 1. They ought therefore to have appeared less than half the just-resolvable initial angular size, which is consistent with Arnold's report that at this point he could no longer resolve their shapes other than as specks of light. But pelicans seen on LOS 4 would now be *twice as close* as they had been at the start of the timing on LOS 1, and would subtend *twice* the angular size they intially subtended, because they are, relatively speaking, *approaching* the plane, not receding from it. (Remember that we are modelling for a maximum possible pelican speed including the full benefit of a 19kt wind vector; lowering the pelican speed rapidly increases this problematic enlargement factor.)

Thus any reduction at all in initial pelican distance below 3 miles is strictly speaking unacceptable, and in addition to the worsening angular size *trend* it isn't long before we encounter an absolute lower bound, as follows:

Clearly it is geometrically impossible to reduce the initial range below 1.2 miles (1.9km) because the bird then has zero time to get out of the way of the plane whilst still reaching alignment with Mt Adams on LOS 4, and by the end of the clocking transit it would have to be right outside the cockpit, its 3.0m wings blotting out not merely Mt Adams but half the southern horizon. Note that even 1.2 miles is still more than twice the range required for a 1.0m-long bird to subtend the 3 arcmin lower limit to show a just-resolvable shape in profile.

During the rotation of the LOS towards LOS 4 the pelicans are not only approaching the plane, but also rotating to a tail-on aspect and in so doing exposing a larger projected area of their white backs. At the same time they are reducing their angle from the sun²⁶⁰ by 80° and consequently increasing the reflective efficiency of their plumage. Initially the sun is behind the observer and the plumage is visible only by indirect backscatter of light incident at ~150° leading to relatively low brightness. At LOS 4 the scattering angle has reduced to 70° and the intrinsic plumage brightness will increase due to a small component of more efficient forward scatter or 'forward gloss'.²⁶¹ In addition the perceived brightness will increase like the square of the reducing distance from the observer, or a factor 4. Thus their brighter shapes, now more favourably aspected, and twice as large, ought to have appeared *at least twice as prominent to the eye* when passing Mt Adams as they had been earlier when being "observed quite plainly" near Mt Rainier. This is in notable contrast to Arnold's observation that the objects had by this time dwindled beyond the threshold of resolvability.

260 Az. 232° 37', alt. 57° 48'

261 An interesting study of plumage reflectivity by optical physicist Bruce Maccabee is at <http://www.brumac.8k.com/KARNOLD/KARNOLD.html>

e.) summary of conclusions on the pelican theory

Easton appealed to uncertainties in the aircraft flightpath to counter the argument that Arnold's plane would rapidly have overhauled a flock of pelicans. Having alluded to several (but not all) of the same issues that we have addressed in our reconstructions in Sections 3, 10.iv.b and elsewhere, his bottom line is: "How can we be sure . . . if we don't even know for certain where he was in context at any given time during those approximate two minutes?"²⁶²

It is true that Arnold's exact track on the ground is only knowable within certain brackets, but to focus on this is misleading. It would never be possible to reconstruct the sighting geometry from geographical coordinates alone: Even if we knew exactly Arnold's coordinates at moment t this datum could not be translated into useful information without also knowing exactly where the objects were at the same moment t , and clearly this is not a given but one of the unknowns we have to solve for. What we are required to analyse instead is the internal relationships among a system of fixed and changing angular markers, a system which is to a large extent independent of the geography underneath and is anchored to the landscape within a region of uncertainty limited by a triangulation. Thus, we *do* know Arnold's approximate bearing angles from the moving objects and, simultaneously, from two fixed landmarks, at the start and end of a 102-second period, together with strongly-evidenced limits on the speeds of both moving markers (plane and pelican). This is actually quite an information-rich set of angular and kinematic relationships, from which, within calculable brackets, the significant changing relative positions can indeed be known.

From this reconstruction we can prove convincingly

- that the only sighting geometry capable of reproducing the well-observed angular relationships is *inconsistent* with the reported and otherwise-evidenced aircraft heading,
- and that *even if* this were not the case the constraints on range and angular size are still such that Arnold could scarcely have failed to recognise that he was *approaching* nearby pelicans, not being outdistanced by objects dwindling rapidly in the distance.

The claim of an "obvious" and "amazing" similarity between the reported flight characteristics and those of American White Pelicans can be tested and is not wholly convincing. The diagonal echelon formation is in a general way just as consistent with pelicans as it would have been with aircraft (Section 10.i), but

- of the two more particular characteristics studied - the erratic "jerking" or "flipping", and the object separation - neither is a good fit to typical flap/glide ratios and interbird distances in pelican formations, although this does not of course rule out *atypical* pelican behaviour.

Similarly,

- the presence of migrating or non-breeder American White Pelicans in the West Cascades in late June is improbable in terms of the geographical and seasonal statistical distributions, but on the other hand it is in the nature of statistical distributions that they do have data points far from the mean.

When weighing the balance here we should remember that the original justification for the nearby-bird hypothesis was Kottmeyer's claim that the principal distance cue reported by Arnold - occultation behind the "jagged peak" on Mt Rainier - could not be reliable since (he said) no such

peak seemed to exist. Easton then presented evidence that "established" Kottmeyer's claim, and argued that his own positive identification of the jagged peak as Little Tacoma, on the eastern side of the mountain, was proof that the observed occultation must have been illusory. But we have shown that these criticisms were unfounded:

- Easton's assumed sightline is more than 90° in error; Little Tacoma was not visible from anywhere on Arnold's flight path; and there is indeed a suitable "jagged peak" just where Arnold said it was.

Several predictions of the pelican hypothesis are therefore in varying degrees falsified. Indeed one ought not to forget that the bird hypothesis did not originate with Kottmeyer or Easton. The first to try it out was Kenneth Arnold himself; thus the process of falsification begins, in a sense, on June 24 1947.

In his 1952 book Arnold talked of his early interest in nature. Apparently he was something of an amateur ornithologist in his youth. He implied that it was birdwatching that spurred his early enthusiasm to become a pilot. "As a child my head was always in the clouds," he said. "The reason I enjoyed bird study, I think, was because I so envied their ability to fly."²⁶³ Prior to the sighting he'd spent 3 years flying up to 100 hours a month in the mountains of Washington and Oregon, and the first thing he thought of when he saw the objects, he said, was birds - such as a flight of Canada geese. But he abandoned that fleeting impression immediately because:

a) What had attracted his attention in the first place was "bright flashes" from them that "lit up the surfaces of my airplane". These specular flashes continued to occur. From the very earliest statements he spontaneously described the brightness of these flashes as "just like a mirror" where the sun "seemed to hit the tops of these peculiar looking things in such a way that it almost blinded you".²⁶⁴ In later years he compared them to the brilliance of a welding arc.²⁶⁵ Because this is such a strong feature of Arnold's account from the earliest versions it deserves emphasis. It is apparently not an adaptation or justification responding to criticism and it is difficult to see Arnold's motive for grossly exaggerating what was to him an oddity in terms of his own favoured "airplane" interpretation (an indication of violently erratic flight that would have turned a pilot "to hamburger"). Distant flapping pelicans might well appear as white dots that flash or flicker, and Easton pointed out that birdwatchers have indeed used such language.²⁶⁶ But the similarity appears to be one of language only. Arnold used the term "bright flash" in an explicitly different sense from day one, meaning an illumination that alerted and startled him even before the source of it could be discerned. (For completeness, the reader should consult optical physicist Bruce Maccabee's thorough analysis of the reflectivity of pelican plumage.²⁶⁷)

b) He saw the lower members of this chain of "nickel plated" objects pass behind a particular peak (Section 6) and then apparently "weave in and out" of mountain tops, fixing their range in the region of 20 miles and confirming his subjective impression of high, at least jet-like, speed.²⁶⁸

c) The shovel-like or shell-like shapes which he said he "observed quite plainly", and which he

263 Arnold, K., and R. Palmer, *The Coming of the Saucers*, Amherst, Wisconsin, 1952, pp.5-6

264 Broadcast interview of Kenneth Arnold by journalist Ted Smith, KWRC radio, Pendleton, on June 26, 1947.

265 Arnold, K., "How It All Began" in Fuller, Curtis G., *Proceedings of the First International UFO Congress* [1977], Warner, 1980, pp. 17-29.

266 Easton, J, *Voyager Newsletter - No. 10*, Apr 08 2000 <http://www.ufoupdateslist.com/2000/apr/m07-018.shtml>

267 <http://www.brumac.8k.com/KARNOLD/KARNOLD.html>

268 It is worth recalling that the description of this occultation by the intervening peak is not a later improvisation of Arnold's, produced to justify his claim retrospectively in response to doubts, as might be suspected. It is in early published reports from at least June 26 1947 and in several explicit statements in Arnold's own words, as well as an early (though not definitely dated) detailed drawing (see Section 6 & Appendix 4).

drew many times from the beginning of July 1947, did not resemble birds.²⁶⁹ Kottmeyer (originally suggesting swans) tried to argue a distant similarity, insofar as they at least exhibited "bilateral symmetry", but conceded wanly, "it is a stretch to call the match compelling".²⁷⁰

So Arnold tried the "goose" hypothesis in real time and rejected it immediately for the same reasons that one supposes would have caused him to reject pelicans (presumably he didn't think of pelicans; he never mentions them) and the "escalation of hypotheses" kicked in.²⁷¹ Arnold then concluded they must have been some new type of fast jet fighters, and later - after transferring onto a map the angular transit that he had deliberately timed with his cockpit clock between the prominent markers of Mt Rainier and Mt Adams - he escalated from jets to remote-controlled AAF rockets.

Of course Arnold stopped short of speculating that they might have been "flying saucers" because no such concept was yet in existence (see Section 11). The same was not true approximately a fortnight later when an airline crew made an observation that is arguably the single most striking piece of circumstantial evidence in favour of the pelican hypothesis. The full newspaper report of the incident was as follows:

Spokane, Wash., July 12 (BUP) — A veteran Northwest Airlines pilot who has flown over the Pacific northwest's "flying saucer" country for 15 years today took all the glamor out of the mystery of the flying discs.

All that people have been seeing, he said, are pelicans. Or maybe geese or swans.

Capt. Gordon Moore disclosed that he and his co-pilot, Vern Kesler were saucer-hunting last Wednesday on a regular flight between here and Portland, Ore. Kesler was sure he had seen some flying saucers on July 2, and the pilots were armed with movie cameras and binoculars for another encounter.

"Suddenly we spotted nine big round disks weaving northward two thousand feet below us," Moore related.

"We investigated and found they were real all right --- real pelicans."²⁷²

The first point to note is that the Northwest Airlines flight had taken off from Spokane in the far *east* of Washington State near the border with Idaho, and on its SW heading towards Portland it would have flown right through the heart, not of far-off "flying saucer country" insofar as that is defined by Arnold's sighting, but of "pelican country", as defined by the concentration of nesting and foraging areas in the Columbia Plateau ecoregion in the order of 100 miles east of Mt Rainier. We should be careful not to misinterpret this report as raising the low *a priori* probability that pelicans were flying in the West Cascades that June (see Table 2 & Fig.19).

Secondly, many sightings of commonplace objects flooded into the pages of the press in the weeks after Arnold's story was publicised. The "flying saucers" were an international sensation. Given that pelicans do occur in eastern Washington, and given the heightened alertness of pilots to things in the

269 Oddly, differing descriptions offered by Arnold in later years (see Appendix 4) are - in terms of object shape alone, and setting to one side all other objections discussed - much more conformable to the pelican theory, and we might want to argue that this could be an original suppressed impression now coming freely to the surface. There is also one erratic in the early record: One newspaper quotes Arnold as describing the objects as "somewhat 'bat-shaped'". This *can* be interpreted (in the sense of chiroptera) as an approximate synonym for "bird-shaped". But given that he had initially thought they were geese, that afterwards he readily volunteered the simile that they flew somewhat like geese, and considering the distance and angular size constraints explained in Section 10.iv.d., it surely strains credulity to suppose that, if he thought they also were *shaped like* geese, he would not have recognised that they *were* geese, or more generally, large white birds. In fact there are alternative interpretations of this simile, which are discussed in detail in Appendix 4.

270 Kottmeyer, M., *Resolving Arnold - Part 2: Guess Again*, REALL Newsletter July 1997
<http://www.reall.org/newsletter/v05/n07/resolving-arnold-part-2.html>

271 Hynek, J.A., *The UFO Experience: A Scientific Inquiry*, Abelard-Schuman, London 1972 p.13

272 'Says Flying Saucers Are Pelicans', *New Westminster British Columbian*, July 12 1947

sky, it is not unlikely that anyone spotting distant flying objects indistinctly would run them through that conceptual filter and wonder if they might be "saucers". The fact that Capt Moore saw what he at first characterised as "big round discs" is testimony to the impact of expectation on his perceptual set. But the circumstances are not transferable to the sighting by Arnold who had no expectation of seeing "flying saucers" or indeed anything in particular except perhaps the wreckage of a marine transport plane..

Thirdly Capt Moore "investigated", obviously meaning that he approached them and got a good look, flying over them possibly at a mere 2000ft range when each pelican would have looked about half as big as the full moon. The crucial point, of course, is that he *did* close range with them so as to be able to identify them, because they were flying much slower than his aircraft and/or were on a course intersecting his own, and therefore they could not maintain their separation, still less open the range and disappear in the distance. His encounter therefore dramatises what ought to have happened quite rapidly in Arnold's case, and indeed the more readily in Arnold's case, in the absence of publicity-driven expectation. But it did not happen. In striking contrast to Moore's initial "saucer" excitement, Arnold *began* with the mundane impression of large birds, which (of geometrical necessity) would then have approached his plane, doubling in apparent size during the time he was clocking their speed and confirming this initial identification. But Arnold saw the objects not only pass behind an identifiable peak many miles distant, he also watched them dwindle below the limit of visual resolution in the distance in a known time, therefore abandoning the initial impression of birds. And as we have shown here all quantitative as well as qualitative aspects of the observation do appear consistent with large, distant objects moving much faster than Arnold's plane.

In summary, the pelican hypothesis is superficially attractive but

- certain claimed behavioural similarities are somewhat weaker than they at first appear,

The geometrical relationships required to produce the measured change in relative bearing cannot be satisfied by pelicans because of:

- well-established limits on possible relative airspeeds, and
- testimonial and circumstantial evidence of an inconsistent aircraft heading;

in addition to which pelicans

- cannot satisfy the geometrical relationships required to produce either the observed angular size or the observed change (dwindling) in angular size of the objects, and
- could not reflect sunlight specularly so as to startle an observer before the pelicans themselves became observable.

Finally we draw attention to the fact

- that the original rationale for the pelican hypothesis was a testable prediction about the visible topography of Mt Rainier which is easily falsifiable.

11) Conclusions & conjectures

A fairly recent *Skeptical Inquirer* article²⁷³ by Joe Nickell, advertised as '...a fresh look at the historic 1947 Arnold "flying saucer" sighting', provides a useful framework within which to reprise the various modern critiques of the observation:

.... In the 1920s through the 1940s, science-fiction pulp magazines became popular, especially *Amazing Stories* which debuted in 1929. When its circulation lagged, a new editor, Ray Palmer, boosted sales with wild stories of extraterrestrial visitations and decorated the covers with occasional illustrations of strange, circular spaceships.

It is certainly true that *some* of the many hundreds of wonderful spaceships portrayed on the covers of *Amazing Stories* and several other pulp magazines had discoidal symmetry. Many more had other symmetries, or none. And there is no evidence, as far as this author is aware, that this discoidal imagery had escaped into the wider public consciousness to any degree; whereas there is evidence that Arnold had never read such magazines.

By his own account he was hardly aware of this sector prior to being approached after his sighting by *Amazing* publisher Ray Palmer, whom he had never heard of. He had held comics and pulp fiction in disdain. There is nothing of the geek in the history of this one-time North Dakota state football star and Olympic diving team trialist, now (1947) a successful businessman, father and private pilot. All known witnesses to Arnold's character at this time indicate an affable yet serious and somewhat unimaginative young family man focused on his fire-fighting equipment business.

.... On June 24, 1947, businessman Kenneth Arnold was flying his private airplane over the Cascade Mountains in Washington State when he saw a chain of nine tailless objects . . .

which he did not describe as "circular spaceships", but as "peculiar looking aircraft" that he believed to be new USAAF planes, or something similar launched by a foreign power..

. . . saw a chain of nine tailless objects streaking south over Mount Baker and heading for Mount Rainier,

This is misleading but probably just due to superficial reading. They were not "seen streaking over Mt Baker", which was about 140 miles north of Arnold. They were actually seen streaking over Mt Rainier and heading for Mt Adams. In 1952 Arnold recalled²⁷⁴ that the objects appeared to be "coming from the vicinity of Mt Baker", indicating the northerly direction from which the objects appeared to be approaching Mt Rainier. A quarter-century later in his 1977 retrospective,²⁷⁵ he spoke of seeing flashes "coming from a group of objects far up to the north of Mt. Rainier, in the area of Mt. Baker", which clearly means the *angular*, not geographical, vicinity of Mt Baker. He could scarcely have seen anything 140 miles away, and of course even at the "incredible" speeds Arnold measured they would have taken fully 5 to 7 mins even to reach Mt Rainier from Mt Baker, whereas his entire sighting only lasted half this time. So it is consistent that the earliest sources make clear that he initially spotted them only "a few seconds" before their shapes became resolvable and "very shortly" before they approached Mt Rainier.²⁷⁶ "I looked to the left and north of Mt Rainier where I observed a chain of nine peculiar looking aircraft . . . They were approaching Mt Rainier very

273 Nickell, Joe, 'Mysterious Entities of the Pacific Northwest, Part II', *Skeptical Inquirer*, Vol. 31.2, Mar / Apr 2007
http://www.csicop.org/si/show/mysterious_entities_of_the_pacific_northwest_part_ii/

274 Arnold, K., and R. Palmer, *The Coming of the Saucers*, Amherst, Wisconsin, 1952, p.10-11.

275 Arnold, K., "How It All Began" in Fuller, Curtis G., *Proceedings of the First International UFO Congress* [1977], Warner, 1980, pp. 17-29

276 Kenneth Arnold, report to the Commanding General, Wright Field, Dayton Ohio, 12pp typescript c. July 08 1947 (NICAP/UFOS files)

rapidly"²⁷⁷ and "I noticed to the left of me a chain . . . going at a terrific speed across the face of Mt. Rainier".²⁷⁸

each flying with a motion like "a saucer skipped across water". The name "flying saucers" was thus born, and Ray Palmer's fiction had become a reality.

The real story of the origin of this classic phrase is more complicated and uncertain, and this glib assertion of cause and effect requires justification. See Appendix 4.

By the following year, Palmer had helped create Fate, a mystery-mongering magazine that promoted UFOs and other "true" mysteries (as it continues to do today). Palmer went on to co-author a book with Arnold, *The Coming of the Saucers* (1952).

Skeptics have put forth numerous explanations for Arnold's UFOs: balloons, airplanes, hoaxes, hallucinations, mountain-top mirages, birds, droplets of water on the plane's windshield, etc.

All of them having significant and in most cases immediately fatal shortcomings. It is tempting to suppose that the probability of scoring an explanatory hit is proportional to the number of conjectural shots fired, in the sense that if so many explanations can be conceived then, surely, one of them must be right? But it would be less unreasonable to infer that the longer the history of serial failure then the stronger the null hypothesis that no successful explanation is likely to be found.

Arnold claimed he had viewed the objects carefully, even opening his window and taking off his glasses.

This last statement might easily be interpreted as suggesting that Arnold's vision was impaired because he had removed his glasses. But Arnold did not wear corrective spectacles. What he said was that he was *not wearing sunglasses*, to emphasise that his view of the objects was unobstructed.

He calculated the objects' speed at 1,200 to 1,700 mph, an incredible figure. Edward J. Ruppelt, former head of the U.S. Air Force's Project Blue Book, which investigated UFOs, wrote of the controversy, noting two factions' arguments at the Air Technical Intelligence Center (ATIC). One side thought Arnold simply saw jet airplanes flying in formation: The "Arnold-saw-airplanes" faction maintained that since Arnold said that the objects were 45 to 50 feet long

Arnold did not say that the objects were 45-50ft long. See Section 8.

they would have had to be much closer than he had estimated or he couldn't even have seen them at all.

This claim (of Hynek's) was ophthalmologically grossly incorrect. See Section 8.

Since they were much closer than he estimated, Arnold's timed speed was all wrong and instead of going 1,700 miles per hour the objects were traveling at a speed closer to 400 miles per hour, the speed of a jet. There was no reason to believe they weren't jets.

A better summary would be: By ignoring certain features of the report, and by arguing crudely from inaccurate premises, Hynek was able to suppress several reasons for believing they were not jets.

277 *Ibid.*

278 Broadcast interview of Kenneth Arnold by journalist Ted Smith, KWRC radio, Pendleton, on June 26, 1947.

See Sections 8, 9 & 10.i.

The jets appeared to have a skipping motion because Arnold had looked at them through layers of warm and cold air, like heat waves coming from a hot pavement that cause an object to shimmer. (Ruppelt 1956, 28)

This superadded theory does not really make atmospheric-optical sense. See Section 10.ii.

The other faction at ATIC noted Arnold's claim that the UFOs had passed behind one mountain peak, thus supposedly helping establish their correct distance from him. (This faction thus thought the objects must have been about 210 feet long instead of Arnold's estimated 45 to 50 feet [Ruppelt 1956, 28—29]).

This "45 to 50 feet" figure originates in an inaccurate AAF document. See Section 8.

However, physicist/UFOlogist Dr. Bruce Maccabee (1995) has noted: "Geological survey maps show that mountain peaks behind which the objects could have disappeared have altitudes of 5,000 to 6,000 feet. Thus it appears that they were lower than 6,000 feet and that Arnold overestimated their altitude." More recently, other evidence has shown that Arnold must have been mistaken about the objects traveling behind a peak (Easton 2000).

The author is unaware of any evidence that has "shown Arnold must have been mistaken" about this. It is certainly true that the objects would have been somewhat lower than Arnold's estimate, but not for the reason cited. Arnold's estimate was based on a minor confusion between the terrestrial and astronomical horizons; moreover this is latent information which tends to improve rather than degrade the internal consistency of the report (see Section 6). James Easton and others disputed the existence of any occulting secondary peak SW of the summit of Mt Rainier, and concluded that since no such visible peak existed Arnold must have been talking about an *invisible* peak (on the other side of the mountain), meaning that he could not possibly have seen what he claimed to see, an incoherent canard repeated uncritically here by Nickel. But Easton and Nickell are mistaken. An appropriate peak - Glacier Island - does in fact exist exactly where Arnold said it did (see Sections 4, 5 & 6).

Ruppelt himself noted that Arnold's story had been "warped, twisted, and changed" by the "bards of saucerism."

This is irrelevant to the question of what Arnold originally reported, but in point of fact his story has been warped and twisted with at least equal relish by the critics of those bards.

He [Ruppelt] added: "Even some points in Arnold's own account of his sighting as published in his book 'The Coming of the Saucers', do not jibe with what the official files say he told the Air Force in 1947."

Some points in that official file, written by AAF officers and recycled by Ruppelt, do not jibe with what we know Arnold told them in his own official report - which is part of that file - and with his earliest descriptions recorded in the newspapers and on the radio. This official failing is not only less forgivable and more methodologically significant, but has had a greater negative effect on the controversy, than any changes of detail that crept into Arnold's recollection five years later (of which there are in fact almost none, only one being of consequence). A witness cannot be held responsible for another's misplaced reliance on his five-year-old memories when contemporaneous sources are available.

[At this point Nickell deconstructs the report of a similar and reportedly near-simultaneous sighting by mineral prospector Fred Johnson. This critique is discussed separately in Appendix 3]

It seems plausible that Arnold could have mistaken jet airplanes for unusual flying objects. He himself thought he had seen some newly developed government aircraft. However, the Air Force disavowed ownership of the objects.

That "Arnold himself" initially made the assumption that they were jets, but after considered observation and quantitative measurements abandoned the theory, does not make it *more* plausible that he saw jets, as Nickell seems to imply, rather it tends if anything to make it *less* plausible.

James Easton (2000) has ventured an explanation that begins with Arnold's obvious distance-size-speed misperceptions

Nickell is incorrect. There are no such "obvious misperceptions" in Arnold's report. His estimates of distance (topographically limited), angular size (calibrated against a target of known width in real time), and absolute size (judged to be ~100ft) are all quite self-consistent and do lead to the range of speeds he calculated based on his clock-timed angular speed measurement. Nickell appears to be alluding back to the erroneous 1948 argument of Hynek.

and his likening the objects' flight characteristics to "a formation of geese" (Arnold and Palmer 1952, 11). Easton's suspects are the very large American white pelicans, who are among the largest birds in the world, are "highly reflective," fly at high altitudes, and employ a distinctive undulating flying motion, flapping and gliding, that compares well with Arnold's statement that the UFOs "fluttered and sailed" (qtd. in Maccabee 1995, 1:16).

There are certainly some *prima facie* similarities to a formation of pelicans in terms of behaviour and appearance. But as discussed in detail in Section 10.iv, on examination the typical flying and flocking behaviours of pelicans actually do *not* "compare well" with Arnold's description, and the Seattle Audubon Society records the abundance of American White Pelicans in the West Cascades at any time of year as negligible (lower than the lowest non-zero positive measure of abundance which is "rare"). Moreover when investigated properly the time-, speed-, distance- and angle-constraints on any possible pelican sighting geometry render the hypothesis effectively unsupportable.

Indeed, not longer [sic] after the Arnold-Johnson sightings, on July 2, "a veteran Northwest Airlines pilot who has flown over the Pacific northwest's 'flying saucer' country for 15 years" spotted nine "big round discs weaving northward two thousand feet below us." Capt. Gordon Moore (1947) stated, "We investigated and found they were real all right—real pelicans."

This is an interesting account which does indeed contain lessons for the interpretation of Arnold's sighting, though they are not necessarily the conclusions that Nickell invites us draw. See Section 10.iv.e.

Still, not only UFO proponents but also many skeptics doubt the pelican scenario. I interviewed Major James McGaha (USAF ret.)—a pilot, UFO expert, and director of the Grasslands Observatory in Tucson, Arizona. He thinks a much more likely explanation for Arnold's UFOs (he dismisses Johnson as a probable copycat) is "mountain-top mirages".

To suspect a copycat is not an unreasonable first guess. But in fact such evidence as we have does not support the idea. Copycats are presumably motivated by desire for notoriety or at least publicity

for some purpose. If Johnson had wanted to he could have gone to the papers. He did not. He approached the Army Air Force discreetly and the only known sources relative to his report are confidential official ones. The FBI assessment of Johnson was that he appeared to be "a very reliable individual". The AAF conclusion on his report was "unknown" These are not good grounds on which to "dismiss" Johnson (see Appendix 3).

McGaha notes that the conditions under which Arnold saw the strange objects—clear skies, smooth air, a potential temperature inversion—were ideal for producing mirage effects.

Obviously a "potential temperature inversion" could, potentially, cause a mirage.

So was the angle of the sun: 50.4 degrees from the horizon.

Nickell implies that a sun elevation of 50.4°²⁷⁹ is some sort of critical angle "ideal for producing mirage effects" but this mysterious claim makes no physical sense whatsoever. Mirage effects are limited to light rays intercepting a layer of anomalous temperature gradient at grazing elevation angles of a fraction of *one* degree, and in any case the sun was 150° of azimuth away from the line of sight, behind the observer, in the opposite part of the sky.

Arnold's insistence that the objects were "flying very close to the mountain tops" and seemingly "swerved in and out of the high mountain peaks" (Arnold and Palmer 1952, 10, 12) is fully consistent with the mirage hypothesis, states McGaha (2006).

This is quite untrue. The description of objects in fast horizontal flight "swerving in and out of the mountaintops" is explicitly and dramatically *inconsistent* with mirage. As reported by Nickell, McGaha here betrays a degree of basic scientific illiteracy that is distressingly common in supposedly scientific treatments of Arnold's observation. Light ray bending in nature occurs almost exclusively in the vertical direction except for small-scale scintillations or in special conditions when rays pass adjacent to strongly heated nearby surfaces (such as a vertical hot wall). And even the displacements that do occur are limited to small angles usually much less than a degree of arc. The possibility of systematic lateral image displacements due to temperature gradients in the free atmosphere is essentially zero, even over small visual angles at the limit of perceptibility, and smooth lateral translations through a visual arc in the order of 100° are quite impossible.

In any event, the Arnold case is instructive. The implication of UFO proponents that—because the objects are "unidentified" and the incident "unexplained"—the Arnold sighting is therefore evidence of extraterrestrial visitation is absurd. Not only is such an attitude mystery mongering, but it is also an example of a logical fallacy called arguing from ignorance: One cannot draw a conclusion from a lack of knowledge.

This is somewhat reasonable.

The problem is not a failure of science nor of excessive skepticism but rather Arnold's own conflicting versions of what he saw and the serious misperceptions he quite obviously made. Such is often the case with reports of alien sightings.

This is not so reasonable. There are in reality several problems, including some variation in details offered by Arnold in later years (see Appendix 4); but Nickell's "serious misperceptions [he] quite obviously made" - referring here to Hynek's claimed inconsistencies of size and distance - do not constitute one of them. All of the quantities explicit and implicit in Arnold's original reports of his observation (which emphatically was *not* an "alien sighting") are found to be mutually consistent to

279 I find the true sun elevation to be 57° 48'.

within a very reasonable margin (see Sections 8 & 9). There is actually no internal evidence of serious misperception in those sources. But there is, in contrast, clear evidence of serious official errors in the ATIC file, and of serious error and misrepresentation in various published accounts, both by advocates of anomaly and by critics purporting - like Nickell - to dispose of it.

One theory that Nickell does not mention and which has been popular in some quarters for many years is that Arnold saw more or less exactly what he thought he saw - revolutionary high-performance jets, developed in secret by the AAF from captured Nazi wartime designs and hardware. Advocates of this theory point to resemblances between the crescent-shaped design of one of the nine objects as depicted in publications by Arnold after 1950 (in later years Arnold began to claim that all of the objects had been shaped like this) and the experimental flying-wings of the Horten brothers in Nazi Germany.

History records that there was no US Horten-style program. The British had the Horten brothers and some of their work in the UK in summer 1945 and tried to get them to cooperate in further development but they seem to have failed in this. There certainly doesn't seem to be any evidence that the US got hold of a number of operational Hortens. Only some prototype Horten hardware did go to the US at this time:

Construction of the H IX V3 was nearly complete when the Gotha Works at Friederichsroda were overrun by troops of the American 3rd Army's VII Corps on April 14, 1945. The aircraft was assigned the number T2-490 by the Americans. The aircraft's official RLM designation is uncertain, as it was referred to as the Ho 229 as well as the Go 229. Also found in the destroyed and abandoned works were several other prototypes in various stages of construction, including a two-seat version. The V3 was sent to the United States by ship, along with other captured aircraft, and finally ended up in the H.H. "Hap" Arnold collection of the Air Force Technical Museum. The wing aircraft was to have been brought to flying status at Park Ridge, Illinois, but budget cuts in the late forties and early fifties brought these plans to an end. The V3 was handed over to the present-day National Air and Space Museum (NASM) in Washington D.C.²⁸⁰

This account doesn't explicitly rule out the possibility that some working versions were constructed and flown in secret before those budget cuts closed the programme. One can always make the argument that if there was even a small chance that Horten designs might have been flown in the US in June 1947, then probability favours the conclusion that Arnold must somehow (in spite of arguments to the contrary; see Section 10.i) have misjudged the speed and/or distance of these unfamiliar jet wings by a factor 3.

But the first problem is that there is no sign in any of the once secret documents - which presumably no one ever imagined might become public - that anyone in the US military, in or out of technical intelligence, was aware of any connection between these Nazi designs and the "flying discs", even though both came under the aegis of the same Army Air Force T-2 foreign technology evaluation office from which Projects Sign, Grudge and Bluebook evolved. That makes no sense, unless the Horten work was a "deep black" programme classified away even from Air Material Command and the USAF Director of Intelligence. It is true that General Twining did speculate about the possibility of some high-security project "unknown to this Command" in his secret AMC recommendation to instigate Project Sign. But aside from continuing absence of evidence of such a programme, why would a rather well-known technology like the flying wing attract such fantastic security?

A second and related problem is that Jack Northrop in the US, among others, had been building and

280 Dabrowski, H. P., *The Horten Flying Wing in World War II: The History & Development of the Ho 229* (Schiffer Military History Vol. 47) <http://greyfalcon.us/restored/A%20few%20items%20here%20don.htm>

demonstrating flying wings since 1939²⁸¹ and had a well-established history with the military. He had been contracted to develop long range flying-wing bombers by the US Army Air Corps in 1941 and the XB-35 first flew on June 25 1946 - almost exactly a year before the Arnold sighting (it was given a 3-page illustrated spread in the January 1947 *Popular Science* magazine shortly before Arnold's sighting; see Appendix 4.d). The US poured huge money into this, going four times over budget, but still the programme was blighted with problems and 11 production aircraft were left unfinished and unflown when the design evolved into the YB-49 jet-powered wing in summer 1948. But this too had unresolvable problems with stability and proved hopeless for its designed strike role, so the AF poured another \$88 million into a redesigned reconnaissance version, the YRB-49. They ordered 30 of these, but again the thing was a flop and petered out in 1949. The one flying version was finally airborne in 1950 and flown only as far as its graveyard in California.²⁸²

If there was a super-secret underground programme of jet Hortens flying in numbers before June 1947 then a great deal of money and effort was wasted on Northrop's XB and YB series, not to mention numerous subsequent aircraft programmes, as well as the staffing and organisation of Projects Sign, Grudge, Bluebook and their various subsidiary programmes and activities during the next 22 years.

And finally, although a mature Horten jet like the Ho 229, rendered operational, should have been capable of speeds rivalling the world record for a subsonic jet in 1947 (over 600mph), nothing that is known, even today, about any flying wing or other aircraft programme in this era hints at airspeeds of Mach 2 or 3. This is not a question of design refinement: Exceeding even Mach 1 safely proved unachievable for any flying wing airframe, and the basic engine and materials technology necessary to make possible a hypersonic manned aircraft - of any design - did not exist.

So if real Horten flying wings could not have been seen by Arnold, might there be some other explanation of why he described objects that so many people recognise as being similar to them? Of course Arnold had not always described the objects in the same terms (see Appendix 4.e) The history of the development of this imagery over several decades is complex to trace and not immediately easy to explain. An attempt to understand it is made in Appendix 4.a, where it is concluded that Arnold may have been motivated by a wish to court the good opinion of the reticent military authorities. The Army had disappointed him by their initial lukewarm response to what he believed was a serious matter. It ought to have been of concern to the nation's defenders, he reasoned, for if the objects were not US assets then they must be those of a potential enemy. Stung by the implication that he was being taken no more seriously than any kook with a wild story for the papers, Arnold would have been motivated to deprecate his role in the saucer craze by tending to emphasise the less saucer-like aspects of the discoids he originally drew in early July 1947.

The flying wing was at the time the public face of futuristic aviation and Arnold tells us²⁸³ that ex-military airmen of his acquaintance had been briefed during the war about the possibility of encountering revolutionary aircraft designs in overseas combat. It is likely that Arnold kept his ear to the ground and by the 1950s may have found out more about the German flying wings and allied confiscation of designs and part-built airframes. Might his desire for respectable acceptance have been motivation for wanting to reinvent his story, morphing his nine chopped discoids into nine crescents, each with a point in the rear like a vestigial fuselage, resembling somewhat the Horten Ho229?²⁸⁴

281 His earliest experiments go back to 1929 and the founding of the Avion Company to manufacture the 90hp *Alpha* quasi-wing concept demonstrator. http://www.nurflugel.com/Nurflugel/Northrop/flying_wing/flying_wing.html

282 <http://www.dau.mil/pubs/arq/2001arq/Baker.pdf>

283 Letter to the Commanding General, Army Air Forces, Wright Field, on or about July 12 1947 (Appendix 1)

284 There were Horten designs with and without the vestigial "tail" point - like the famous Ho229 and the "Parabel"

respectively http://www.nurflugel.com/Nurflugel/Horten_Nurflugels/horten_nurflugels.html

http://www.nurflugel.com/Nurflugel/Horten_Nurflugels/ho_parabel/parabola.jpg

A further argument against theories of the Horten "secret weapon" type, and others of a type yet more exotic, is the objection made by many, including for example Kottmeyer,²⁸⁵ that if large objects had been hurtling over a scenic National Park area there should have been many potential witnesses on the ground, even though the area is sparsely populated. Why did only Arnold see them?

Arnold's sighting has indeed always been considered as a single-witness sighting, and its probative value deprecated accordingly. For example, in the absence of triangulation from a second viewpoint the official AF evaluation was free to cast doubt (even if not well-founded) on Arnold's judgments of distance and speed. And even if, on closer scrutiny, the internal consistency and plausibility of Arnold's observation can be re-established (Sections 8 & 9), it remains possible to argue that a single datum from a single source can always be dismissed as a statistically improbable freak. We need independent observations to calibrate our observing instrument (Mr Arnold) before taking it seriously..

Yet there is a curious anomaly. The AF entirely ignored the fact that sitting in their own files was another confidential report describing a similar group of objects reported by another observer located in the same area of the Cascades at the same time, which extraordinarily had - and still has - the distinction of being the very first official "unidentified" in the AF files. This is the case of mineral prospector Fred Johnson, which is discussed in detail in Appendix 3.

The Johnson sighting is in fact not the only ground sighting in the region that day. Three "kite-shaped" objects were reportedly sighted at 10:00 that morning heading south from Bellingham towards Seattle. Three "discs" were then seen from Richland, Washington, at 2:30 (30 mins before Arnold's sighting) heading towards the Mt Rainier area. At about the same time as Arnold's sighting a witness 10 miles south of Mineral saw nine "shiny" objects "flashing overhead" at high speed. A Washington Forest Service look-out in the Cascades reported seeing a number of bright flashing objects travelling in a line at altitude southeast of Mt Adams the same afternoon, making a "strange noise, higher pitched than an airplane". These reports are also discussed in Appendix 3.

There is no question that the single most emphatic lesson of the more than 70 years of sightings following Arnold's seminal report is that the human capacity for visual misidentification is large. Justifying the pelican hypothesis, Vancouver ornithologist Michael Price recently spoke of

the myriad ways in which an observer could wander sometimes incredible distances from a clinical description. To borrow a well-known example from astronomy, the planet Venus generates many UFO reports, especially when an evening star. It is a simple bright, stationary point of light, yet people's descriptions of it have sometimes approached the surreal and the grotesque.²⁸⁶

Price compares Arnold's report to "surreal and grotesque" misperceptions of Venus by suggestible people who expect to see UFOs, but of course this is why Arnold's case is such an interesting laboratory for exploring these ideas: On June 24 1947 there were no UFOs, no saucers, no powerful cultural context of people seeing these things, and no reason to suspect any expectation on Arnold's part of seeing anything at all that day. So Price is not properly controlling the protocols of the experiment and his result is not transferable or reliable.

In a similar vein sceptical investigator Dr David Clarke writes:

285 Kottmeyer, M., *Resolving Arnold - Part 2: Guess Again*, REALL Newsletter July 1997

286 Price, M., Letter to the Editor, *Fortean Times*, April 2010

I find the argument that someone with Arnold's knowledge was able to rule out birds etc²⁸⁷ comparable to Col Halt's assurance that he could not possibly mistake a lighthouse for a UFO.²⁸⁸ What is impossible to reconstruct is the psychology of the moment - what happens in the human brain when you see something completely unexpected and unanticipated. Something that might otherwise, in a different context, be interpreted as a completely normal occurrence (i.e. a flock of birds or a lighthouse beam), becomes extra-ordinary in the heat of the moment.²⁸⁹

Despite the claim (which has a degree of truth) that it is not possible to reconstruct the psychology of the moment, Clarke's approach is, in fact, tacitly to reconstruct the psychology of Col. Halt's moment and then to use it as a model from which to reconstruct the psychology of Arnold's. The real problem here is that the Halt psychology is an inappropriate model for this purpose.

Halt was very familiar with the concepts of saucers and aliens. Thanks to 33 years of global publicity these motifs were bred in the bone. He was surrounded by other people who also knew all about saucers and aliens. Dramatic sightings and claims of landings had been made by people known to him in recent hours. He and his entourage, all steeped in decades of saucer mythology, went out into the forest in the dead of night with geiger counter and low-light scope to look for a UFO. And they found one.

On June 24 1947 the psychology of the moment was that Kenneth Arnold, a man who by his own account had never read any science fiction and scorned pulp magazines like *Amazing Stories*, was flying home to his wife and children after making a sale of firefighting equipment in Chehalis. He had no expectation of seeing anything. It was a nice day. No one had ever heard of flying saucers.

In later life Arnold became more speculative and also allowed certain details of his original story to change. But we have found no quantitative or qualitative evidence internal to Arnold's original testimony that would contradict the impression of a somewhat careful observer and a conscientious reporter. Neither is there any source known to the author claiming external evidence that would tend to cast doubt on Arnold's honesty and general dependability. On the contrary, reports from Army Air Force Counter-Intelligence Corps agents²⁹⁰ who interviewed him in 1947, and character testimonials sought by the AAF from others such as aviation journalist David Johnson,²⁹¹ uniformly support the picture of a straightforward, responsible and realistic individual unlikely to have been overmastered by fantasies.

In 1975 the Editor of the Washington *Tri-County Herald*, William Bequette, who as a young reporter had interviewed Arnold at length on the day after his sighting and wrote the first press stories, recalled for the *Oregon Journal*: "Arnold never suggested that he had seen a spacecraft or anything like that. I believe he was just curious about what he had seen and wanted to know what it was. He was a sensible guy. I never could buy the accusations that he made up these stories."²⁹² And for sociologist Pierre Lagrange in 1988 Bequette added: "Mr. Arnold did not impress me then as a person who 'saw things.' And Nolan Skiff [a colleague of Bequette's on the *East Oregonian*] also

287 The present author had made the point (discussed here in Section 10.iv.e) that the first ever explicit test of the bird hypothesis was made by Arnold himself in real time. I was not of course suggesting that Arnold's rejection of this hypothesis was of itself sufficient to 'rule out' birds.

288 Clarke refers here to the infamous and controversial Rendlesham Forest affair of December 1980 when a number of USAF security police and others including Base Commander Col. Halt reported encountering an unknown object in the woods near RAF Woodbridge/Bentwaters.

289 Clarke, D., ufology-in-uk email list post, 26.02.2010

290 Brown, Frank M., S/A CIC 4th AF, Memorandum for the Officer in Charge, Incident 4/F 1208 I, July 16 1947 (ATIC files)

291 Notarised statement of David. M. Johnson, aviation editor, *Idaho Daily Statesman*, before the Notary Public for Ada County, Idaho, at Boise, Idaho, July 12 1947 (ATIC files)

292 'Cub Scribe Broke Story', by James Long, Staff Writer, *Oregon Journal* Oct 17 1975

believed Mr. Arnold to be an honest and sincere person who was genuinely puzzled by what he had seen that day. Arnold was most cooperative when I went to his hotel room for a follow-up story. He seemed eager, as I remember, to answer all my questions as fully as possible."²⁹³

The author and journalist John A. Keel, who was not overly impressed by Arnold's sighting,²⁹⁴ nevertheless conceded that Arnold was "an astute observer and a meticulous reporter"²⁹⁵ Jerome Clark, who also knew Arnold personally and had worked as an editor for *Fate* magazine (the publication founded originally by Ray Palmer which had carried Arnold's story in its first summer 1948 edition; see Appendix 4) described him as "honest and honorable" and "a strikingly unimaginative man whose life revolved around nothing much outside family and business"²⁹⁶

Whether or not Arnold's mysterious hypersonic discoids really existed remains, apparently, forever unproveable. But we can reasonably conclude that the scenario described by Arnold does seem to be geographically, geometrically and optically coherent, despite claims to the contrary re-echoed irresponsibly in some parts of the literature for many years, and that even the most promising published explanations turn out to be for various reasons very unlikely.

But where does one go from here? If our best effort - arguably the pelican hypothesis - really does not work well, what have we accomplished? Why, for so many investigators, is such a failure regarded as an achievement and a reason for excitement?

At this point the traditional resort of these optimists is to the Extra-Terrestrial Hypothesis (ETH) - spacecraft from elsewhere in the cosmos, or something closely analogous. It would be an exaggeration to say that this hypothesis was not available in 1947; it certainly was, but it was an idea at the fringe of society, lacking the sanctions either of authority or of popularity. It was not in practice available to Kenneth Arnold and it apparently did not occur to him. But within a matter of weeks it had surfaced and become the dominant idea in the evolution of our modern saucer myth. Ever since it has gathered popular acceptance and, arguably, scientific sanction, as we have increased our understanding of the physics of the cosmos and of how planets and living organisms emerge and evolve.²⁹⁷

But although possible ET life and ET visitation are today both scientifically grounded and somewhat conventional ideas there is no direct evidence for them independent of the sighting evidence which they are being invoked to explain; therefore in terms of the principle of simplicity or economy (otherwise known as Occam's razor) there is an unaccountable but non-zero cost involved in invoking them. This is where explanatory entities such as pelicans score so strongly: We know pelicans exist; the cost of invoking them, at least in principle, is literally zero. There are costs in practice, of course, such as requiring atypical behaviours and/or large *ad hoc* revisions of the report data; and the sum of these costs might be fairly large; but the sum is at least known to be finite. Strictly speaking, we cannot say for sure that the improbability of ET visitation might not be infinite.

Thoughts such as these give rise to the point of view expressed by folklorist and journalism lecturer Dr David Clarke:

Granted, it's unlikely [that Arnold saw pelicans], but in what order of unlikeliness is it compared with the explanation that he saw a) piloted craft from an extraterrestrial

293 Quoted at: <http://www.brumac.8k.com/KARNOLD/KARNOLD.html>

294 He misrepresented it as merely a few 'lights' seen from 50 miles away and attributed the rest to revisionism by Ray Palmer. See Appendix 4.

295 Keel, J.A., 'The Maury island Caper', in: Evans & Spencer (eds.), *UFOs 1947-1987*, Fortean Tomes 1987, p.41

296 Clark, J., Project 1947 email list post, 09.03.2010

297 Some such theory also seems necessary to explain why no one reported any sonic booms (see also Appendix 3).

civilisation or b) foreign or US advanced aircraft?²⁹⁸

Of course one understands the psychological force of this question. But in scientific logic it is impossible to answer clearly unless we can agree how to quantify before-hand the probabilities not only of a) and of b) but also of c) - which stands for an indefinitely large equivalence class of other hypotheses that are not enumerated and/or not even known to us. How can we know whether a possibility crudely articulated (or yet to be suspected) is really going to be a simplifying or complexifying factor in the context of a model of the world which exists only in the future?

In short we cannot. This sort of ranking exercise can only be defended by very general *a priori* principles which, like the principle of simplicity or economy itself, are really not justified by anything found in nature. The principle of simplicity is merely "an empirical hypothesis concerning the structure of theories and the structure of the world [which] is regularly refuted," points out the philosopher of science Rom Harré, adding "There has hardly ever been any theory in any field of scientific investigation that has not been shown to be an oversimplification of the phenomena and their causes, when they are more closely scrutinised."²⁹⁹

The complexity of the principle of simplicity is a fascinating sort of self-negation. It is the abiding lesson of the history of science that the world turns out to be *more* complex than our initial impressions suggest, and the reason why the principle of simplicity has acquired such an exalted status is itself a difficult and complicated question to unravel. Perhaps it is easy to understand the attractiveness on a popular level of a simple principle which seems to promise that the "obvious" solution is more likely to be correct than a hi-falutin' one: It undercuts scientific elitism. But why scientists espouse it is less clear. In actual scientific practice economy does not appear to be a reliable guide and attempts to apply it are fraught with ambiguity.

For example, is a small number of complex relations less costly in some sense than a large number of simple relations? Is an hypothesis like the existence of ET intelligence, introduced as a "new" component into our interpretation of experience, really new and complexifying if its probable truth is already implicit in the rest of science? Does an added hypothesis always complicate? No, it does not. Arguably the most intelligible formulation of the principle of economy or paucity is the Barker-Kemeny formulation in which the complexity or logical cost of a theory is measured by the number of possible worlds in which it could be true.³⁰⁰ The simplest theory would be true in only one world, the most complex would be true in all possible worlds and in this sense is profligate. But counterintuitively, this means that plugging an additional hypothesis into a theory can radically simplify it, by making it inconsistent with some number of possible worlds, even if the added hypothesis is arbitrarily complicated.

Plainly, one soon disappears down a logical rabbit hole in trying to weight hypotheses on *a priori* grounds. These judgments are always subjective, often justified by appeals to elegance and aesthetics, and tend to reduce in practice to a type of strategy that one hopes will tend to minimise effort, i.e., "playing the percentages". Crudely and intuitively it will always prove safest on average, in the aggregate and over time, to bet that nothing truly unusual happened in any given case. One will be right much more often than one is wrong. But that doesn't mean that the errors we will inevitably make using this kind of cautious presumption will individually be insignificant errors. The audit risk of error is the product of its probability and its impact. The scientific impact may still be arbitrarily large, and the audit risk proportional, even if the *a priori* probability of error per-bet-laid is small.

298 Clarke, D., ufology-in-uk email list post, 27.02.2010

299 Harre, R., *The Anticipation of Nature*, Hutchinson, London 1965 p.104

300 Barker, S.F., *Induction and Hypothesis; A Study of the Logic of Confirmation*, Cornell U.P. Ithaca N.Y 1957

In the end, "The anticipation of nature is a fraud", as Harré put it, and "there is no method other than the painstaking inspection of things and phenomena, to see whether our theories are right or wrong."³⁰¹ Following this advice in the present case leads us to conclude that various theories that have been proposed during more than six decades, theories which would be regarded as simple in the sense of being conservative and introducing no new physical hypotheses, do not fair well under painstaking inspection.

Perhaps one ought to say no more than that. But it is fair to add that it is a result which would not have been predicted six decades ago by the conservative hypothesis that Arnold's saucers were some simple trick of the light, of the mind, or of the weather. And this perspective takes us away from *a priorism*.

Predictivity is highly valued in science because it is the *testing* of conjectures, irrespective of their content or origin, that has proved the only sound practical guide to truth. By the beginning of July 1947 a class of theories had begun to emerge according to which Arnold had been innocently deceived by some ordinary phenomenon, giving rise to a silly rumour fed by suggestible copycat eyewitnesses and whipped up by the press. An implicit prediction of this class of theories (indeed, often made explicit) was that as time went by the apparent "facts" would fall apart, Arnold's sighting would prove to be flawed and incoherent, the saucers would have a simple explanation, and another "silly season" rumour would run out of steam.

The last part of this prediction was spectacularly falsified. Instead of fading away the reporting of UFOs became over the years more widespread, and the sightings became more intriguing, better witnessed, richer and stranger in detail, and more challenging to the scientists and military technical intelligence professionals charged with explaining them, until five years after Arnold's sighting the problem was affecting military policy decisions at the highest levels of the US government. It would be fair to say that the prominent scientific issues that came into focus in 1952 remain to a large degree still unresolved 58 years later.

Regarding the Arnold sighting in particular, it was an implicit prediction of the trivial misperception theory in 1947 that the study of more and better-filtered and better-calibrated information in 2010 ought to either *a*) expose telling signs of error and inconsistency in the *prima facie* story with which Arnold had so excited Americans 63 years before, and/or *b*) provide better reasons for thinking a conventional, natural explanation likely. As we have seen, some errors and inconsistencies have from time to time been claimed; but the conclusion of the present study is that this prediction also is refuted. Examination of the sighting report in detail improves its evident internal consistency, rather than degrading it, and study of the principal contending explanations reveals that they are each very much less attractive when tried out in quantitative detail against the best information than they may appear at first sight.

In David Clarke's opinion the most interesting lesson to be learned today from Kenneth Arnold's remarkable sighting is about

what happens in the human brain when you see something completely unexpected and unanticipated. Something that might otherwise, in a different context, be interpreted as a completely normal occurrence (i.e. a flock of birds or a lighthouse beam), becomes extraordinary in the heat of the moment. That's the magic bit that fascinates me!³⁰²

One is forced to agree. That is a fascinating bit of magic. And since the day when a bewildered Kenneth Arnold landed at Pendleton Municipal Airport with his extraordinary story in June 1947

301 Harre, R., *The Anticipation of Nature*, Hutchinson, London 1965, p.7

302 ufology-in-uk list post 27/02/2010

there have certainly been many observations that can be comfortably resolved within this framework. At the same time there has been a persistent residue of others which - like Arnold's - cannot, and which remain "unknown" after the best efforts of people skilled in explaining how the human eye and mind can be puzzled by unusual but conventional things.

The explanation of this fact may still prove entirely trivial. Nevertheless some of these observations are - by ordinary eyewitness standards, at least - rather well evidenced. To date, this fact has not proved sufficient to make a strong case for exotic hypotheses in the class of the ETH. But it has been widely held to be sufficient to justify invoking the hypothesis that there may be electromagnetic/meteorological phenomena in Earth's atmosphere that we still do not understand. And one lesson we ought to draw from this, clearly, is that misperception is not the only possible bit of magic in nature.

Appendix 1. Three sighting narratives by Kenneth Arnold: 1947; 1952; 1977

a) *Live broadcast interview with Kenneth Arnold by Ted Smith, radio KWRC, Pendleton, June 26 1947*³⁰³

TED SMITH:

The nation, every newscaster, and every newspaper across the nation has made headlines out of it, and this afternoon we are honored, indeed, to have here in our studio this man, Kenneth Arnold, who, we believe, may be able to give us a first-hand account and give you the same on what happened.

Kenneth, first of all if you'll move up here to the microphone just a little closer, we'll ask you to just tell in your own fashion, as you told us last night in your hotel room, and again this morning, what you were doing there and how this entire thing started. Go ahead, Kenneth.

KENNETH ARNOLD:

Well, about 2:15 I took off from Chehalis, Washington, en route to Yakima, and, of course, every time that any of us fly over the country near Mt. Rainier, we spend an hour or two in search of the Marine plane that's never been found that they believe is in the snow someplace southwest of that particular area. That area is located at about, its elevation is about 10,000 foot, and I had made one sweep in close to Mt. Rainier and down one of the canyons and was dragging it for any types of objects that might prove to be the Marine ship, uh, and as I come out of the canyon there, was about 15 minutes, I was approximately 25 to 28 miles from Mt. Rainier, I climbed back up to 9200 feet and I noticed to the left of me a chain which looked to me like the tail of a Chinese kite, kind of weaving and going at a terrific speed across the face of Mt. Rainier. I, at first, thought they were geese because it flew like geese, but it was going so fast that I immediately changed my mind and decided it was a bunch of new jet planes in formation.

Well, as the plane come to the edge of Mt. Rainier flying at about 160 degrees south, I thought I would clock them because it was such a clear day, and I didn't know where their destination was, but due to the fact that I had Mt. Saint Helens and Mt. Adams to clock them by, I just thought I'd see just how fast they were going, since among pilots we argue about speed so much.

And, they seemed to flip and flash in the sun, just like a mirror, and, in fact, I happened to be in an angle from the sun that seemed to hit the tops of these peculiar looking things in such a way that it almost blinded you when you looked at them through your plexiglass windshield.

Well, uh, I uh, it was about one minute to three when I started clocking them on my sweep second hand clock, and as I kept looking at them, I kept looking for their tails, and they didn't have any tail. I thought, well, maybe something's wrong with my eyes and I turned the plane around and opened the window, and looked out the window, and sure enough, I couldn't find any tails on 'em. And, uh, the whole, our observation of these particular ships, didn't last more than about two and a half minutes and I could see them only plainly when they seemed to tip their wing, or whatever it was, and the sun flashed on them.

They looked something like a pie plate that was cut in half with a sort of a convex triangle in the rear. Now, I thought, well, that maybe they're jet planes with just the tails painted green or brown or something, and I didn't think too much of it, but kept on watching them. They didn't fly in a

303 See transcript at <http://www.brumac.8k.com/KARNOLD/KARNOLD.htm>. The author has made a couple of small changes to the above version on the basis of the audio file of the original tape (discovered by Pierre Lagrange) available at <http://www.ufologie.net/htm/arnoldrepsmith.htm>,

conventional formation that's taught in our army, they seemed to kind of weave in and out right above the mountaintops, and I would say that they even went down into the canyons in several instances, oh, probably a hundred feet, but I could see them against the snow, of course, on Mt. Rainier and against the snow on Mt. Adams as they were flashing, and against a high ridge that happens to lay in between Mt. Rainier and Mt. Adams. But when I observed the tail end of the last one passing Mt. Adams, and I was at an angle near Mt. Rainier from it, but I looked at my watch and it showed one minute and 42 seconds. Well, I felt that was pretty fast and I didn't stop to think what the distance was between the two mountains.

Well, I landed at Yakima, Washington, and Al Baxter was there to greet me and here ...[unintelligible]... And, ah, he told me, I guess I better change my brand, but he kind of gave me a mysterious sort of a look that maybe I had seen something, he didn't know, and well, I just kind of forgot it then, until I got down to Pendleton and I began looking at my map and taking measurements on it. And, the best calculation I could figure out, now even in spite of error, would be around 1200 miles an hour, because making the distance from Mt. Rainier to Mt. Adams, in, we'll say approximately two minutes, it's almost, well, it'd be around 25 miles per minute. Now allowing for error, we can give them three minutes or four minutes to make it, and they're still going more than 800 miles an hour, and to my knowledge, there isn't anything that I've read about, outside of some of the German rockets, that would go that fast. These were flying in more or less a level, constant altitude. They weren't going up and they weren't going down. They were just simply flying straight and level and I, ha ha, I laughed and I told the fellows at Pendleton, they sure must have had a tailwind. But it didn't seem to help me much. But to the best of my knowledge, and the best of my description, that is what I actually saw, and, uh, like I told the Associated Press, I'll, I'd be glad to confirm it with my hands on a Bible because I did see it, and whether it has anything to do with our army or our intelligence or whether it has to do with some foreign country, I don't know. But I did see it and I did clock it and I just happened to be in a beautiful position to do it and it's just as much a mystery to me as it is to everyone else who's been calling me the last 24 hours, wondering what it was.

TED SMITH:

Well, Kenneth, thank you very much. I know that you've certainly been busy these last 24 hours, 'cause I've spent some of the time with you myself, and I know that the press associations, both Associated Press and our press, the United Press, has been right after you every minute. The Associated and the United Press, all over the nation, have been after this story. It's been on every newscast, over the air, and in every newspaper I know of. The United Press in Portland has made several telephone calls here at Pendleton to me, and to you this morning, and from New York I understand, they are after this story, and that we may have an answer ...[unintelligible]... because, if it is some new type of army or navy secret missile, there would probably a story come out on it from the army or navy asking, saying that it is a new secret plane and that will be all there is to it, and they will hush up the story, or perhaps that we will finally get a definite answer to it.

I understand the United Press is checking on it out of New York now with the Army, and also with the Navy, and we hope to have some concrete answer before nightfall. We certainly want to thank you, Kenneth for coming into our studio. We feel very pleased that this news which is making nationwide news across the country, we are able to give our listeners over KWRC a first-hand report direct from you, of what you saw. And we urge our listeners to keep tuned to this station, because anytime this afternoon or this evening, and we get something on it on our United Press teletype, which is in direct communications with New York, Chicago, Portland, in fact, every United Press bureau across the nation, why, we'll have it on the air.

b) Letter from Kenneth Arnold to the Commanding General, Army Air Forces, Wright Field, about July 08 1947.³⁰⁴

CONFIDENTIAL

COPY

The following story of what I observed over the Cascade mountains, as impossible as it may seem, is positively true. I never asked nor wanted any notoriety for just accidentally being in the right spot at the right time to observe what I did. I reported something that I know any pilot would have reported. I don't think that in any way my observation was due to any sensitivity of eye sight or judgment than what is considered normal for any pilot.

On June 24th, Tuesday, 1947, I had finished my work for the Central Air Service at Chehalis, Washington, and at about two o'clock I took off from Chehalis, Washington, airport with the intention of going to Yakima, Wash. My trip was delayed for an hour to search for a large marine transport that supposedly went down near or around the southwest side of Mt. Rainier in the state of Washington and to date has never been found.

I flew directly toward Mt. Rainier after reaching an altitude of about 9,500 feet, which is the approximate elevation of the high plateau from which Mt. Rainier rises. I had made one sweep of this high plateau to the westward, searching all of the various ridges for this marine ship and flew to the west down and near the ridge side of the canyon where Ashford, Washington, is located.

Unable to see anything that looked like the lost ship, I made a 360 degree turn to the right and above the little city of Mineral, starting again toward Mt. Rainier. I climbed back up to an altitude of approximately 9,200 feet.

The air was so smooth that day that it was a real pleasure flying and, as most pilots do when the air is smooth and they are flying at a higher altitude, I trimmed out my airplane in the direction of Yakima, Washington, which was almost directly east of my position and simply sat in my plane observing the sky and the terrain.

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 foot elevation.

The sky and air was clear as crystal. I hadn't flown more than two or three minutes on my course when a bright flash reflected on my airplane. It startled me as I thought I was too close to some other aircraft. I looked every place in the sky and couldn't find where the reflection had come from until I looked to the left and the north of Mt. Rainier where I observed a chain of nine peculiar looking aircraft flying from north to south at approximately 9,500 foot elevation and going, seemingly, in a definite direction of about 170 degrees.

They were approaching Mt. Rainier very rapidly, and I merely assumed they were jet planes. Anyhow, I discovered that this was where the reflection had come from, as two or three of them every few seconds would dip or change their course slightly, just enough

for the sun to strike them at an angle that reflected brightly on my plane.

These objects being quite far away, I was unable for a few seconds to make out their shape or their formation. Very shortly they approached Mt. Rainier, and I observed their outline against the snow quite plainly.

I thought it was very peculiar that I couldn't find their tails but assumed they were some type of jet plane. I was determined to clock their speed, as I had two definite points I could clock them by; the air was so clear that it was very easy to see objects and determine their approximate shape and size at almost fifty miles that day.

I remember distinctly that my sweep second hand on my eight day clock, which is located on my instrument panel, read one minute to 3 P.M. as the first object of this formation passed the southern edge of Mt. Rainier. I watched these objects with great interest as I had never before observed

airplanes flying so close to the mountain tops, flying directly south to southeast down the hog's back of a mountain range. I would estimate their elevation could have varied a thousand feet one way or another up or down, but they were pretty much on the horizon to me which would indicate they were near the same elevation as I was.

They flew like many times I have observed geese to fly in a rather diagonal chain-like line as if they were linked together. They seemed to hold a definite direction but rather swerved in and out of the high mountain peaks. Their speed at the time did not impress me particularly, because I knew that our army and air forces had planes that went very fast.

What kept bothering me as I watched them flip and flash in the sun right along their path was the fact that I couldn't make out any tail on them, and I am sure that any pilot would justify more than a second look at such a plane.

I observed them quite plainly, and I estimate my distance from them, which was almost at right angles, to be between twenty to twenty-five miles. I knew they 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 with them - 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 furthest engines on each side of the fuselage of the DC-4.

The more I observed these objects the more upset I became, as I am accustomed and familiar with most all objects flying whether I am close to the ground or at higher altitudes. I observed the chain of these objects passing another high 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. I could quite accurately determine their pathway due to the fact that there were several high peaks that were a little this side of them as

well as higher peaks on the other side of their pathway.

As the last unit of this formation passed the southern most high snow-covered crest of Mt. Adams, I looked at my sweep second hand and it showed that they had traveled the distance in one minute and forty-two seconds. Even at the time this timing did not upset me as I felt confident after I would land there would be some explanation of what I saw.

A number of news men and experts suggested that I might have been seeing reflections or even a mirage. This I know to be absolutely false, as I observed these objects not only through the glass of my airplane but turned my airplane sideways where I could open my window and observe them with a completely unobstructed view. (Without sun glasses)

Even though two minutes seems like a very short time to one on the ground, in the air in two minutes time a pilot can observe a great many things and anything within his sight of vision probably as many as fifty or sixty times.

I continued my search for the marine plane for another fifteen or twenty minutes and while searching for this marine plane, what I had just observed kept going through my mind. I became more disturbed, so after taking a last look at Tieton Reservoir I headed for Yakima.

I might add that my complete observation of these objects, which I could even follow by their flashes as they passed Mt. Adams, was around two and one-half or three minutes -- although, by the time they reached Mt. Adams they were out of my range of vision as far as determining shape or form. Of course, when the sun reflected from one or two or three of these units, they appeared to be completely round; but, I am making a drawing to the best of my ability, which I am including, as to the shape I observed these objects to be as they passed the snow covered ridges as well as Mt. Rainier.

When these objects were flying approximately straight and level, they were just a black thin line and when they flipped was the only time I could get a judgment as to their size.

These objects were holding an almost constant elevation; they did not seem to be going up or coming down, such as would be the case of rockets or artillery shells. I am convinced in my own mind that they were some type of airplane, even though they didn't conform with the many aspects of the conventional type of planes that I know.

Although these objects have been reported by many other observers throughout the United States, there have been six or seven other accounts written by some of these observers that I can truthfully say must have observed the same thing that I did; particularly, the descriptions of the three Western [Cedar City, Utah] Air Lines employees, the gentleman [pilot] from Oklahoma City and the locomotive engineer from Illinois, plus Capt Smith and Co-Pilot Stevens of United Air Lines.

Some descriptions could not be very accurate taken from the ground unless these saucer-like disks were at a great height and there is a possibility that all of the people who observed peculiar objects could have seen the same thing I did, but, it would have been very difficult from the ground to observe these for more than four or five seconds, and there is always the possibility of atmospheric moisture and dust near the ground which could distort one's vision.

I have in my possession letters from all over the United States and people who profess that these objects have been observed over other portions of the world, principally Sweden, Bermuda, and California.

I would have given almost anything that day to have had a movie camera with a telephoto lens and from now on I will never be without one - - but, to continue further with my story. When I landed at Yakima, Wash., airport I described what I had seen to my very good friend, Al Baxter, who listened patiently and was very courteous but in a joking way didn't believe me.

I did not accurately measure the distance between these two mountains until I landed at Pendleton, Oregon, that same day where I told a number of pilot friends of mine what I had observed and they did not scoff or laugh but suggested they might be guided missiles or something new. In fact several former Army pilots informed me that they had been briefed before going into combat overseas that they might see objects of similar shape and design as I described and assured me that I wasn't dreaming or going crazy.

I quote Sonny Robinson, a former Army Air Forces pilot who is now operating dusting operations at Pendleton, Oregon, "What you observed, I am convinced, is some type of jet or rocket propelled ship that is in the process of being tested by our government or even it could possibly be by some foreign government."

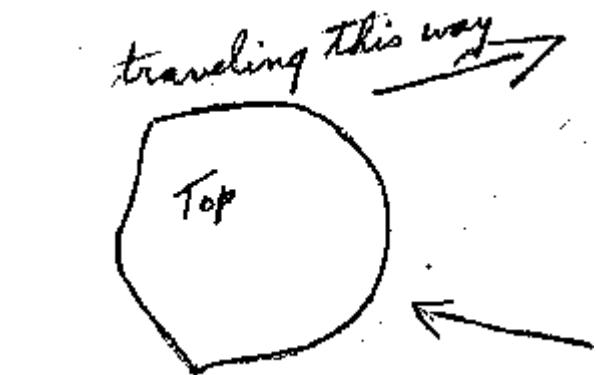
Anyhow, the news that I had observed these spread very rapidly and before the night was over I was receiving telephone calls from all parts of the world; and, to date, I have not received one telephone call or one letter of scoffing or disbelief. the only disbelief that I know of was what was printed in the papers.

I look at this whole ordeal as not something funny as some people have made it out to be. To me it is mighty serious and since I evidently did observe something that at least Mr. John Doe on the street corner or Pete Andrews on the ranch has never heard about, is no reason that it does not exist. Even though I openly invited an investigation by the Army and the FBI as to the authenticity of my story or a mental or a physical examination as to my capabilities, I have received no interest from these two important protective forces of our country; I will go so far as to assume that any report I gave to the United and Associated Press and over the radio on two different occasions which apparently set the nation buzzing, if our Military intelligence was not aware of what I observed, they would be the very first people that I could expect as visitors.

I have received lots of requests from people who told me to make a lot of wild guesses. I have based what I have written here in this article on positive facts and as far as guessing what it was I observed, it is just as much a mystery to me as it is to the rest of the world.

My pilot's license is 333487. I fly a Callair airplane; it is a three-place single engine land ship that is designed and manufactured at Afton, Wyoming as an extremely high performance, high altitude airplane that was made for mountain work. The national certificate of my plane is 33355

/s/ Kenneth
Arnold
Box 587
Boise, Idaho



They seemed longer than wide, their thickness was about 1/20th their width



Mirror Bright

They did not appear to me to whirl or spin but seemed in fixed position traveling as I have made drawing.

/s/ Kenneth Arnold

c) *Transcript of talk given by Kenneth Arnold at the First International UFO Congress in Chicago, Illinois, June 24, 1977.³⁰⁵*

As I came out below on this first sweep I passed over a little community of Mineral, Washington, the pine trees there, and knew pretty much where I was. I made a turn at probably 2000 ft over Mineral, Washington and started climbing back slowly but steadily climbing, to gain sufficient altitude to go back on the high plateau again for another pass at this mountain. As I was making this turn and, of course flying directly toward Mt. Rainier, at about 9200 ft elevation... it was a beautiful day, in fact the plane was very stable, I didn't have to fight controls or weather or anything... a tremendous flash appeared in the sky and it lit up my whole aircraft, even it seem the cockpit of the airplane and I was rather startled.

I thought I hadn't seen a plane that was very close to me, or possibly it had been a military plane that had dove over my nose and the reflection of the afternoon sun against his wing surfaces had

305 This transcript version made made by Bruce Maccabee <http://www.brumac.8k.com/KARNOLD/KARNOLD.html>

caused the flash. Now this just, in less than one tenth of a second, I think, went through my mind. I looked all around below me and looked ahead of me. And then the flashcame again and, uh, this very, very bright flash, it was almost like an arc light, was coming from a group of objects far up to th north of Mt. Rainier, in the area of Mt. Baker, which is almost in a lie with Mt. Rainier and Mt. Adams. I observed a chain of very, very peculiar aircraft approaching Mt. Rainier very rapidly ,,, I think I described them like the tail of a chinese kite. They seemed to be in an echelon formation However, in getting a look at them against the sky and against the snow of Mt. Rainier as they approached. I just couldn't discern any tails on them, and I had never, never observed an aircraft without a tail. Particularly these were of fairly large size and there was nine of them in number. I was good at counting things like this because I flew missions counting antelope, sheep , cattle, and what not in the course of my lifetime, and the first craft...

I kept searching for their tails. I was quite surprised that I couldn't find their tails. I was aware that the military was very clever at camouflage and I was, of course assuming all the time that these were military craft or at least military missiles. I was puzzled because the fomation of their echelon travel which was at 170 degrees, which is south, from north to south, following very closely to the Cascade Range, their formation as I observed it seemed to the first craft was at a higher elevation than all the rest of craft, which, of course, is not conventional military formation at all, in either this country or Russia or Germany or anything that I had ever heard of before. So I just assumed, in a flash, that they were some new type of military missile or jet and possibly remote controlled. They didn't fly likeairplanes actually. This brilliant flash that came from their surfaces, which I assumed was from the sun reflection at first, would pulsate and they would flutter like this and sail. And they seemed to fly just as readily on edge as they did on a level. As I mentioned before they seemed like they were linked together in a sort of diagonal chain-like formation, similar to geese, but, uh (chuckle) they were not geese. I was very puzzled about that. However, I made a special note, they were all independent. Individually they were flying on their own, but every once in a while one of them would give off a flash like this and gain a little more altitude or deviate just a little bit from the echelon formation. And this went periodically on among the.. alternattingly, I should say, not in regular rhythm particularly..., among all the nine craft I was observing.

When they approached Mt. Rainier's north edge, I could see they were to the west of Mt. Rainier, to me, which was a very good observation from my standpoint, because I was at right angles to them,. I determined that if they were missiles or whatever they were I was going to clock their speed, or make an attempt to clock their speed. Now, around airports most pilots are always arguing about the speed of military craft, they're always arguing about the speed of their own planes. And I just thought, oh , it's a beautiful day and I've got a beautiful viewpoint here and I'm going to clock their speed even though I was closer to Mt. Rainier than to Mt. Adams, which was directly to the south and in their line of flight. I was going to clock their speed with my 24 hour clock which has a big sweep second hand on my instrument panel.

As the first one, putting its nose out of the southern edge of the snowfield of Mt. Rainier, my sweep second had was just approaching, if I remember it correctly, about one minute to three. I think it was just going over the three. And they kept, of course flying and...in between Mt Rainier and Mt Adams there is quite a lot of rough, high terrain, it's been named for many years goat ridge. I don't know why. Supposedly because it is very rough and very steep. But this goat ridge, as I later flew it, is approximately 5 miles long. Is in a line similar to this. I was approaching Mt. Rainier. I realized that my attempt to clock their speed absolutely accurately would have been hopeless because I was rapidly approaching Mt. Rainier at 9200 ft at about a hundred miles an hour, steadily climbing myself and of course they were passing from north to south and, uh, anyhow, what took place was that, as the first one was passing this goat ridge... as the first one actually passed the end of goat ridge the last one seemed to enter above the goat ridge. I made a guess that the formation of these peculiar aircraft was approximately 5 miles long. Now this estimation is purely an

estimation because the goat ridge is quite irregular. It isn't running at exactly 170 degrees. But I was getting some kind of a judgement as to how long the formation was. These craft seemed to be climbing a little bit as they were following this 170 degree heading and I knew that I was on a level with them because they were on a horizon with me, so my altimeter showed a little over 92 hundred feet, so they were flying at an elevation of about 92 hundred, probably a little less or a little more as they sort of undulated , if you want to call it that, as they flew.

As the... to be quite sure, as the last of this echelon formation of these strange aircraft actually passed Mount Adams, and to the best of my judgement were above a little bit, some of them, the head one was a little above Mt. Adams, I looked at my sweep second hand, and they had covered that distance of about 50 miles in a minute and 42 seconds. I didn't really, I knew they were flying really fast. I knew they were faster than our P-51's, or any planes I knew of militairly speaking, However, I didn't really try to figure out how many miles they were going. Somehow I had a rather unusual feeling about it. Because of their size, and I judged their size to be probably, a hundred feet, their wingspan a hundred feet in diameter.

And, of course, I was very puzzled by the fact that they didn't have tails. But I got a good look at their image on the snow,. Now, when they gave off this flash they would appear to be round. When they turned lengthwise or flatwise to me they were very, very thin. And actually they disappeared behind a sharp projection on Mt. Rainier in the snow field to my eyesight. And, since I knew approximately where I was, flying of course toward the mountain, I knew where they had passed. I thought my judgement and my clocking could be within reasonable limits as to about how fast they were going. As they were going past this goat ridge the second from the last one seemed, it was not reflecting and it seemed to turn its rear end toward me. I guess that's the best expression I can use. And I could see that it was a very wraith-like looking thing, but it wasn't round at all. And the other ones gave me the impression they were rather like a tadpole. If you've ever seen a tadpole they have a little sort of a peak at their rear. But I couldn't quite positively determine if they were all the same design as this one I particularly noticed or whether they were ... Actually this one was a little larger , it seemed a little darker in color than the others and its wingspan seemed a little bit lighter. Of course a leader of a group of craft of this kind would, of course, you would assume would probably be the first ship. This was second from the last one and the last ship I couldn't see too well because he was fluttering and jerking very rapidly.

The way that they performed was that, if there was a human being in them, they would have been made into hamburger at the first turn because they were going very fast and very erratically and they could change their direction almost instantly and it would have been awfully hard. The centrifugal must have been terrific, if there were human beings on them. This is the reason that gave me the impression that they must robotly guided missiles.

Anyhow I sort of lost interest in my search mission and I decided that maybe I ought to go to Yakima and report it. Now in my craft in order to save weight so I can make high altitude take offs with it on short airfields I don't carry a lot of radio gear. I just had a small, little radio that I could contact the control tower with. I didn't need expensive and elaborategear and so I couldn't very well call Seattle tower, I couldn't call Tacoma tower or McCord or anything. I just kept flying on the way they had traveled across the Cascade range and on to Yakima.

I felt positive in my own mind as I was continuing my flight to Yakima the forest observatories which run up and down the Cascades just couldn'tpossibly have missed seeing them because they were large and very distinct and there was quite a formation of them. However, I later found out that they had observed them but they had given their report not to the press or not to the public but of course to their superiors which, everything ends up eventually, I guess, in the Pentagon. I don't know.

So I landed at Yakima and I knew the pilots there. Al Baxter was the general manager of Central Aircraft. He was an examiner as well, and I explained this all to him and I said they didn't have any tails and I told him the approximate size and I mentioned the tremendous speed and acceleration they had and the seemingly effortless way they flew. And he was really quite puzzled. We had been friends for a long time and he knew that I wouldn't make such a report unless it was absolutely true. Many of the helicopter pilots in the area had come in that afternoon and one of them mentioned, Well, Ken, I think you saw some of those guided missiles from Moses lake. I said I never heard of guided missiles from Moses Lake. I thought, well maybe that's what it is. And I felt satisfied that that's probably what they were.

Appendix 2. Weather

Weather data for the state of Washington on June 24 1947 are few and far between. No radiosonde balloon records are extant. Not many stations have historical archives of surface weather going back before this date, either, and the few that do often have records missing for the couple of years after 1945. Some of the surviving records are unfeasibly remote from the sighting area, and none of them preserves complete hourly observations. So useful data are limited to a few scattered daily temperatures and some scant information for Seattle and Stampede Pass collected by McDonald in 1966.

*From the masthead of the Pendleton East Oregonian, Wednesday, June 25 1947*³⁰⁶

OFFICIAL WEATHER REPORT

Tuesday [June 24]: Max 90, min 59, mean 74,
eight degrees above normal
Wednesday: Min 64

*Seattle, Boeing Field (~55mi NNW of Mt Rainier) radiosonde observations, evening of June 24 1947*³⁰⁷

'... at 700 mb, or about 10,000 ft, the winds were 19 kts from direction 300° (NW). As you mentioned on the phone, the winds aloft were out of the NW most of the way up that day. The fact that the dew points aloft ran about 10°C below air temperature surely supports your recollection that there were no clouds ... [T]he radiosonde for that day shows relative humidities below about 50% from about 5000 ft up. Today I received from the Seattle USWB office a copy of the hourly observations at Boeing Field for that afternoon. From 1330 through 1630 PST they show completely clear skies. At 1700 and 1730 (late as I asked for) they had thin scattered clouds. This appears to check your recollections. The visibility was 15 miles-plus, and they had a good surface wind, about 10 kts, so haze ought not have precluded the observer seeing lenticular clouds over Rainier. But to check this point still further I have written today to the WB stations at Toledo and at Stampede Pass to get their cloud observations, if available.'

*Stampede Pass weather station surface obs (1200m el., ~36 mi NE of Mt Rainier)*³⁰⁸

The sky conditions on the 24th of June 1947 in the Stampede Pass area were as follows:

1300 hrs	Clear
1400 hrs	Scattered, 1 / 10 Cumulus and Cirrus, Cu bases 3000'
1500 hrs	Scattered, same as above
1600 hrs	" " "
1700 hrs	" " "
1800 hrs	" " "

306 Scan of front page in: Lagrange, P., 'How it all Began', Anomalies: l'Observateur des Parasciences #3, 1997

307 McDonald, Dr. J.E, letters to Kenneth Arnold, Nov. 8 and 9, 1966.

308 Ira D. Smylie, Technician in Charge, US Weather Bureau, ESSA, Easton, Washington, letter to J. E. McDonald, Institute of Atmospheric Physics, University of Arizona, Tucson, Arizona. November 21, 1966.

Yakima surface obs (~60mi ESE of Rainier) June 24 1947 ³⁰⁹

	actual	historical mean for date	historical max.
Mean Temperature	24 °C	18 °C	--
Max Temperature	34 °C	27 °C	38 °C (1992)
Min. Temperature	15 °C	8 °C	3 °C (2007)

Tacoma, McChord AFB surface obs (~40mi NW of Rainier) June 24 1947 ³¹⁰

meanT	maxT	minT	pressure	meanRH	precip.	vis/km	meanWind/km	maxWind/km
19°C	27.2	8.9	1018.4	57%	0	11.4	9.1	25.9

Fairchild AFB surface obs (~200 mi ENE of Rainier) June 24 1947 ³¹¹

meanT	maxT	minT	pressure	meanRH	precip.	vis/km	meanWind/km	maxWind/km
22.8°C	29.4	12.2	1014.1	29%	0	48.9	8.0	16.5

309 <http://www.wunderground.com/history/airport/KYKM/1947/6/24/DailyHistory.html>

310 <http://www.tutiempo.net/en/Climate/USA/Washington/WA.html>

311 Ibid.

Appendix 3. Other reports of sightings in Pacific NW area June 24 1947

In 1977 Arnold recollects:

I felt positive in my own mind as I was continuing my flight to Yakima the forest observatories which run up and down the Cascades just couldn't possibly have missed seeing them because they were large and very distinct and there was quite a formation of them. However, I later found out that they had observed them but they had given their report not to the press or not to the public but of course to their superiors which, everything ends up eventually, I guess, in the Pentagon. I don't know.³¹²

But in his 1947 AAF letter Arnold commented that although there had been several other sightings - especially from pilots - which he was confident must have been of the same things he saw in the clear air at 9000ft, in most cases of sightings from the ground he had doubts. And with regard to his own sighting he commented that

it would have been very difficult from the ground to observe these for more than four or five seconds [because such fast objects flying near overhead would pass from horizon to horizon in a few seconds] and there is always the possibility of atmospheric moisture and dust near the ground which could distort one's vision³¹³

which suggests that by early July he was not very optimistic about getting corroboration from other witnesses on the ground. This may have been in part because disappointingly few other sightings had emerged; but in his earliest comments, to journalist Bill Bequette, Arnold had appeared to have a low expectation:

The Boise flyer said they flew on the west sides of Rainier and Adams, adding that he believed this would make it more difficult for them to be seen from the ground.³¹⁴

Some commentators have wondered about the meaning of this, inasmuch as there were probably far more potential ground observers in the rugged but relatively well-inhabited country below the western slopes of Mt Rainier than in the even more rugged interior of the Cascades to the east. The most likely interpretation is that the word "west" was not material; Arnold probably just meant that objects which flew high and close to ("on the side of") the mountain would not be easily visible because any ground observers in the sparsely inhabited valleys nearby would have their line of sight obstructed by the shoulders of the western peaks and foothills of the Cascades, whereas populated areas with a clear view of the peaks would tend to be several tens of miles away.

Another factor of course is limited visibility from roads and dwellings due to local obstructions, and in the vast forested interior of western Washington this means trees. The whole area is densely forested today, and was probably even more so in 1947. The little town of Mineral was the centre of a large logging industry in an area "known for its unusually heavy untouched timber"³¹⁵ and the title of a book about the local history of Mineral and its environs tells its own story: 'The Trees Were So Tall, There Was Nowhere to Look But Up'.³¹⁶ It is easy to appreciate (and a visit to the area on Google Earth 'street view' confirms it) that visibility from roads and settlements in this fairly sparsely inhabited area would have been very restricted.

312 Arnold, K., "How It All Began" in Fuller, Curtis G., *Proceedings of the First International UFO Congress* [1977], Warner, 1980, pp. 17-29

313 Arnold, K., letter to the Commanding General, Army Air Forces, Wright Field, July 08 1947

314 Pendleton, Oregon, *East Oregonian* June 26, 1947

315 <http://www.headquarterstavern.com/>

316 Lavonne Sparkman, *The Trees Were So Tall, There Was Nowhere to Look But Up*
http://minerallake.com/history_books.html



Fig.1 Early photograph of Carlson's sawmill, on the forested shore of Mineral Lake (date unknown)³¹⁷

Nevertheless there were other reports from observers on the ground that day,. No documentation appears to have emerged that would justify Arnold's belief that multiple Forest Service sighting reports may have gone to the Pentagon, but one sighting reached the newspapers from a Forestry Service lookout stationed at Diamond Gap, near Salmon, Washington, and others came from civilian observers in the areas of Bellingham, Richland, Mineral, and Mt Adams, Washington, and of Salem, Oregon.

1) Bellingham, Washington, 10:00 AM.

George Clover, of Bellingham, saw three of the discs when he looked up while rebuilding his house on Tuesday morning [June 24] at 10:00 o'clock.

He described them as "kite-shaped," and said they hurtled straight over head on a southerly course toward Seattle "real fast."

He thought at first they were jets "because they didn't sound like gas engines," although he could make out no wings. With him was Mrs. Clover.³¹⁸

2) Richland, Washington, 2:30 PM

RICHLAND MAN SAW ARNOLD'S FORMATION Richland, Wash., July 4— A Richland, Washington resident has come to the rescue of Kenneth Arnold. L. G. Bernier, in a letter to the *Journal*, said he saw three of the strange objects over Richland on the same day Arnold saw his formation of nine. He believes the three were part of the larger formation.

317 <http://minerallake.com/gallery.html>

318 Tacoma News-Tribune 27 June 1947 (NICAP/CUFOS files/Mary Castner)

Bernier claims he saw the objects "almost edgewise" flying in the direction of Mt. Rainier (northwesterly), about one-half hour before Arnold (about 2:30 p.m.).

"I have seen a P-38 appear....on one horizon and then gone to the other horizon in no time at all, but these discs were certainly traveling faster than any P-38. No doubt Mr. Arnold saw them just a few minutes or seconds later, according to their speed," Bernier wrote.³¹⁹



Fig.2 Locations of witnesses to reported sightings in vicinity of Mt Rainier & Mt Adams around 3:00 PM, June 24 1947. See also Fig.3

- 3) Diamond Gap, near Salmon, Washington, about 20 mi SSE of Mt Adams (time unknown - 3:00pm cited in some sources, but not referenced).

Robert W. Hubach, 587 North Portland blvd., a lookout for the forest service, said Saturday that he saw "some shiny, silver objects that didn't look like airplanes" while he was on duty.

"I was on lookout at Diamond Gap, near Salmon, Washington, Tuesday [June 24] when I heard an airplane. It was black. While I watched it I saw flashes in the distance quite high, up in the east. They seemed to be going in a straight line and I heard a strange noise, higher pitched than an airplane makes," he declared.

Hubach, who said he had not seen a newspaper from the time he started his lookout watch Monday until Saturday, said he believed that the objects were a new type of airplane being tested.

"They did not look like a flying wing," he explained.³²⁰

319 Portland Oregon Journal, Friday, July 4, 1947 (NICAP/CUFOS files/Mary Castner)

320 Portland Oregonian, Sunday, June 29, 1947, p. 24. (NICAP/CUFOS files; Mary Castner)

4) Mineral, Washington, about 3:00 PM

June 24, 1947 - 10 miles south of Mineral, Wash.

About 3 p.m. Sydney B. Gallagher, of Centralia, Washington, was working 10 miles south of Mineral, Washington, when he saw nine bright shiny objects flashing overhead.

The time coincided with Arnold's report.³²¹

5) Salem, Oregon, between 3:00 and 5:00 PM

'FLYING DISCS' SIGHTED AT SALEM.

A Salem woman Thursday added her story to the many. Mrs. Dennis Howell, who lives at the Veterans' Housing colony in southeastern Salem, reports she saw a bright, shiny object tumbling along in the sky between 3 and 5 p.m. on Tuesday [June 24]. She said she thought no more about the sighting until reading of Kenneth Arnold's report of the same date.

Mrs. Howell said she saw only one silvery object, traveling very high, and moving south steadily at a moderate rate of speed.³²²

6) Spanaway, SE Tacoma, Washington (time unknown)

Mrs. Mary Hartwell, Rt. 1, Box 531, Spanaway said Friday [June 27] she had seen "nine planes" very high in the air "two or three days ago" [June 24/25]. She said they had the appearance of geese, but definitely were silver colored planes.³²³

7) Mt Adams, Washington, about 3:00 PM. (Project Sign Incident No. 37)

This sighting report is the most circumstantial as the reporter contacted the Army Air Force, not the newspapers, and was subsequently interviewed by the FBI. The treatment by CSICOP's Joe Nickell,³²⁴ already discussed in Section 11, makes a useful framework for examining this case:

Moreover, Arnold's sighting is significantly different from that of another alleged eyewitness, one Fred Johnson, a prospector who claimed to have witnessed a string of UFOs when he was in the Cascade Mountains on the same day and at about the same time as Arnold flew over.

The legalistic gamesmanship by which Nickell introduces Johnson as a hostile witness invites reluctant admiration. But the claim of "significant difference" is perverse, as we will show.

Johnson's description of the objects differed significantly from Arnold's in their number and appearance. He reported seeing five or six similar objects,

Firstly, notice that whereas Arnold did report seeing nine objects he also said: "They were flying

321 From an unidentified clipping in the USAF files. A handwritten note adds, without citing any source: 'but the objs flew north'. (NICAP/CUFOS files/Mary Castner)

322 Salem, Oregon *Statesman*, Friday, June 27, 1947 (NICAP/CUFOS files/Mary Castner)

323 *Tacoma News Tribune*, June 30 1947

324 Nickell, Joe, 'Mysterious Entities of the Pacific Northwest, Part II', *Skeptical Inquirer*, Vol. 31.2, Mar / Apr 2007
http://www.csicop.org/si/show/mysterious_entities_of_the_pacific_northwest_part_ii/

diagonally in an echelon formation with a larger gap in their echelon between the first four and the last five"³²⁵ - i.e., the *lower* five - and that as they passed Mt Adams they "seemed to gather altitude". So it could easily be the case that a lower, separating group of five remained especially noticeable from Johnson's position.

Secondly, in general, when explaining sightings, any reasonable critic will avail himself often of the principle that human witnesses ought not to be expected to observe and recall everything exactly. For example, if "nine 'Thai lantern' fire balloons" are said to have been launched from a garden at 5:50pm, the fact that a neighbour counted only "five or six" fiery orange balls drifting overhead at about 6:00pm would not divert us from the reasonable conclusion that the two events were related. No sensible person would object that there was a "significant contradiction" in the numbers and conclude therefrom that the fiery balls were coincidental unknowns.

one of which he looked at with his telescope.

Thirdly, he told an FBI agent that he "immediately" focused his telescope on one of the objects which at the time he first spotted it was "banking in the sun". He thought there were "five or six similar objects" but "only concentrated on one", following it with the telescope for 45-60 seconds. When he last looked at the whole group they were "banking into a cloud". Thus there are several reasonable mitigations here for his uncertainty about the number.

It was reflective,

Indeed, he said that his attention was initially attracted to the objects by a bright reflection, which is another point of similarity to Arnold's sighting. Arnold first saw the objects because of bright "flashes" which were apparently specular reflections from their "mirror-like" top surfaces.

"oval," an estimated thirty feet in length, and had a pointed end

which, in Nickell's own terms of reference, ought to count as a "significant" *similarity* to Arnold's description, rather than the significant difference he purports to find. For Johnson, like Arnold, did *not* describe symmetrical saucers. His actual words were: "Round . . . tapering sharply to a point in the lead end in an oval shape." This shape is certainly very reminiscent of the beetle- or shovel-shaped and mirror-surfaced objects that Arnold drew in his own private letter to the AAF, a drawing which (as far as this author has been able to discover) was not published at the date of Johnson's letter.³²⁶

and apparent "tail" (that shifted from side to side).

This odd detail, of "an object in the tail like the hand of a clock shifting from side to side like a big magnet", is indeed unlike anything in Arnold's report. At the same time, the observation by Johnson of an additional detail like this would not be inconsistent with the fact that Johnson was, by his own account, at the very least a factor ten closer to them than Arnold had been, *vidé*:

He estimated the objects were about one thousand feet above him (who was then about five thousand feet above sea level), making their altitude approximately six thousand feet.

This also fits Arnold's account as closely as any cue-free eyewitness judgment of height and distance could reasonably be expected to. Arnold's account suggests a height around 7000ft (see

325 Arnold, K., and R. Palmer, *The Coming of the Saucers*, Amherst Press, Wisconsin, 1952 p10.

326 It is possible to interpret this as meaning that the shape Johnson describes is inverted on the axis of motion with respect to Arnold's, i.e. having a point at the front and an oval trailing edge. But Johnson's letter (see later this Section) shows a poor command of written grammar, spelling and punctuation and the sentence construction is ambiguous.

Section 6). True, Arnold thought that the objects were climbing somewhat as they passed Mt Adams, with the lead objects having risen above the angular height of the mountain whilst the lower, trailing objects passed in front of the snowfields. But if some of the objects were now separating to a higher flight level it would help explain (to the extent that any explanation is necessary) why Johnson only noticed "five or six" out of the nine as they passed him heading south of the mountain. Moreover if the objects were indeed higher and at greater distance than Johnson thought this would tend to suggest that his impression of object diameter ("about 30 feet") should be an underestimate, which would tend to reconcile his impression with Arnold's larger estimate.

Johnson wrote that the "Last view I got of the objects they were standing on edge Banking in a Cloud," although Arnold's account implies a cloudless sky.

Nickell is alleging an inconsistency but it is an extremely weak claim. Arnold was 45 miles NNW of Johnson's position on Mt Adams, and Johnson estimated that he observed the objects in all for about 1 minute heading southeast *past* Mt Adams, viewed to a range of 10 miles with his telescope, then finally with the naked eye, disappearing SE from him at "a speed greater than anything I ever saw". At the speed estimated by Arnold these objects could have been at least 20 miles southeast of Mt Adams when Johnson last saw them heading into the cloud at 6000ft, placing this cloud low on the southern horizon even for Johnson. From Arnold's 9200ft altitude the terrestrial horizon would have been about 120 mi away. A cloud at 6000ft altitude at a distance of 60-70 miles (about 1° above the Earth) would have been only a fraction of 1° above this horizon. Such cloud would be consistent with weather reports indicating the likelihood of 1/10 scattered cloud with cumulus bases around 3000ft over the Cascades to the east of Mts Adams and Rainier with clear skies to the west (Appendix 2; opinions of atmospheric physicists James McDonald and Richard Reed³²⁷) but it would be a completely insignificant sky feature for Arnold, whose description of a clear blue sky near Mt Rainier ought not to be interpreted as ruling out local variability in local cloud cover tens of miles away very low on his horizon, especially given that the sky brightness at such very low elevation is always near-white anyway, even in the bluest sky, because of scattering, and this would tend to make distant low cloud difficult even to discern.

Even if Johnson's contradictory report is put aside . . . Arnold's report alone demonstrates that there is no precise set of facts

No report could ever constitute a precise set of (physical) facts, but Nickell hopes that the smoke from torching that straw man will obscure the qualified value that Arnold's report does have i.e., that it does demonstrate a self-consistent set of plausible observational approximations. And Nickell adds: "Even if Johnson's contradictory report is put aside . . ." The method here is argument by insinuation, the shabbiest kind of journalistic device. By claiming that Johnson's report does nothing but make the "set of facts" less precise, Nickell implies that the Arnold report is stronger without it, and thus perversely encourages the idea that a reader sympathetic to Arnold would be better off ignoring it.

-- he may well have been a publicity-seeking false claimant --

There is no evidence whatsoever that Johnson was seeking publicity. In fact there is positive evidence that he did *not* seek publicity. The only (known) original sources for his story are the files of the Air Force and the FBI. He did not go to the papers or to a radio station, he wrote privately to the Army Air Force. If it were not for the once-secret files of Project Sign we would not even know

327 'I've received the hourlies from Stampede Pass since I came back. They had a tenth of cirrus and low cumulus there at the time of the Arnold sighting, further supporting your view that there could have been a few clouds around the other [east] side of the ridge.' McDonald, J.E., letter to Dr. Richard J. Reed, November 29, 1966. p. 2 (NICAP/CUFOS files; Mary Castner)

that his report existed. Neither is there any evidence that Johnson was lying. The FBI report on their agent's interview states that Johnson "appeared to be a very reliable individual". And Nickell's case (such as it is) is internally inconsistent: The hypothesis that Johnson was a copycat, climbing on the Arnold bandwagon, surely predicts that Johnson would report seeing the same thing as Arnold; yet Nickell concludes that Johnson's story "is significantly different" and so "contradictory" that it can't even be said to relate to the same "set of facts". Nickell wishes to have it both ways here.

Finally, Nickell adds in a footnote:

Johnson gave two slightly differing and confusing accounts, one briefly written, the other summarized by an FBI agent who interviewed him at the request of the Air Force. I have attempted to harmonize the two versions.

Nickell's claim of "differing and confusing" accounts and his "attempt to harmonize" them should be judged by reference to the two documents themselves.

The first is a letter dated August 20 1947, from Frederick M. Johnson to Lt. Col. Donald L. Springer, Assistant Staff, received 22 Aug 1947:

Sir. Saw in the portland paper a short time ago an article in regards to the so called flying disc having any basis of fact. I can say am a prospector and was in the Mt Adams district on June 24th the day Kenneth Arnold of Boise Idaho claims he saw a formation of flying disc. And I saw the same flying objects at about the same time. Having a telescope with me at the time I can assure you they are real and noting like them I ever saw before they did not pass very high over where I was standing at the time. probably 1000 ft. they were round about 30 feet in diameter tapering sharply to a point in the lead end in an oval shape. with a bright top surface. I did not hear any noise as you would from a plane. But there was an object in the tail and looked like a big hand of a clock shifting from side to side like a big magnet. Their speed as far as I know seemed to be greater than anything I ever saw. Last view I got of the objects they were standing on edge Banking in a Cloud.

Yours respectfully

/s/ F.M. Johnson
106 No. West 1st Ave
Portland, Oregon

This letter from Johnson (clearly not a literary man) was passed to the FBI for action and an agent's interview resulted in the following FBI Office Memorandum:

(Fred Johnson, resident of) First Avenue, Portland (Oregon), reported without consulting any records that on June 24, 1947, while prospecting at a point in the Cascade Mountains approximately five thousand feet from sea level, during the afternoon he noticed a reflection, looked up, and saw a disc proceeding in a southeasterly direction. Immediately upon sighting this object he placed his telescope to his eye and observed the disc for approximately forty-five to sixty seconds. He remarked that it is possible for him to pick up an object at a distance of ten miles with his telescope. At the time the disc was sighted by Johnson it was banking in the sun, and he observed five or six similar objects but only concentrated on one. He related that they did not fly in any particular formation and that he would estimate their height to be about one thousand feet from where he was standing. He said the object was about thirty feet in diameter and appeared to have a tail. It made no noise.

According to Johnson he remained in the vicinity of the Cascades for several days and then returned to Portland and noted an article in the local paper which stated in effect that a man in Boise, Idaho, had sighted a similar object but that authorities had disclaimed any knowledge of such an object. He said he communicated with the Army for the sole purpose of attempting to add credence to the story furnished by the man in Boise.

Johnson also related that on the occasion of his sighting the objects on June 24, 1947 he had in his possession a combination compass and watch. He noted particularly that immediately before he sighted the disc the compass acted very peculiar, the hand waving from one side to the other, but that this condition corrected itself immediately after the discs had passed out of sight.

Informant appeared to be a very reliable individual who advised that he had been a prospector in the states of Montana, Washington and Oregon for the past forty years.³²⁸

It is immediately clear that these are not, as Nickell portrays them, "two [contradictory] versions" of Johnson's story needing an "attempt to harmonize" them. They are complementary. The later FBI interview report contains the *same* details as to location, date, time of day, estimated size, altitude, shape etc., that Johnson had set out in his letter to the AAF. But not surprisingly the FBI interview does elicit some supplementary details, chief among which is the one Nickell draws attention to:

In the second [account] Johnson stated he had a combination watch and compass and that, while the craft flew over, the compass needle oscillated unaccountably.

This detail is a fascinating one. It is striking that despite being the very first "unidentified" in the Air Force files Johnson's report had never been well-known even in specialist circles until relatively recent years and was effectively not known at all to the wider public, yet it contained a claim of apparent "electromagnetic effects" prefiguring what was to become one of the major motifs of the UFO phenomenology in a few years.

If accurately reported³²⁹ this is certainly one of the most interesting features of Johnson's story. Could there be a conventional explanation? Possibly. Sporadic magnetic fluctuations might occur naturally due to local geology or random space weather, and it could be mere happenstance. But it is interesting to notice that the summer of 1947 was a solar maximum, a peak time of solar storms. Compasses can fluctuate up to 10 degs in solar geomagnetic storms.³³⁰ The great and so-far unrepeated solar storm of 1859 caused compass errors and navigational problems around the world, as well as telegraph failures and even electrocutions.³³¹

328 <http://www.brumac.8k.com/KARNOLD/KARNOLD.html>

329 It is actually the only detail that *could* be interpreted as suggesting an inaccuracy in the FBI report (on the part of the interviewer rather than the reporter) but this is not noticed by Nickell. The FBI agent's note that "the compass acted very peculiar, the hand waving from one side to the other" seems to pick up an echo from Johnson's original letter in which he said of the discs that "there was an object in the tail and looked like a big hand of a clock shifting from side to side like a big magnet". Is this just coincidence, or could the FBI interviewer have misunderstood an obscurely-phrased remark of Johnson's, misinterpreting a description of the objects' "tails" as referring to motions of Johnson's magnetic compass needle?

330 <http://www.newscientist.com/article/mg13017742.100--solar-flares-send-navigators-off-in-the-wrong-direction-.html> It is presumably also possible that UAP occurrence and geomagnetic fluctuations could both correlate, independently or connectedly, with the solar cycle. Some researchers have observed that other waves of UFO sightings (for example the well-known 1989-90 Belgian wave) occurred during solar maxima. But no truly significant correlation appears to have been established. Indeed others have claimed that the two variables are *anticorrelated* or that UFO waves follow some complicated superposition of different astronomical and terrestrial cycles (see e.g., Rirtovarto, J., 'The Importance of UFO Waves and a Cyclic Connection with Some Curious Links', [MUFON Journal, June 1996](#) #338 pp.7-12)

331 <http://www.scientificamerican.com/article.cfm?id=bracing-for-a-solar-superstorm>

On the other hand solar geomagnetic disruption is associated with solar flare activity. According to the Monthly Notices of the RAS the 1947 maximum was notable for a paucity of flare activity, despite record sunspot sizes and durations. The most intense flare burst was on Apr 06 1947 causing some short-wave interruption and "a pronounced geomagnetic crochet impulse", others in July and August were associated with minor radio fade-outs and magnetic blips; but of 19 geomagnetic storms recorded that year "none were of special intensity" and nothing at all of note appears to have been recorded that June.³³²

And if the "very reliable" Mr Johnson is to be believed, the close correlation between this transient magnetic anomaly and the passage of the discs, on a timescale of seconds, seems arguably more significant than a much weaker correlation with the peak of a solar maximum having a timescale of many weeks. On the other hand, it is possible that Johnson's compass misbehaved on many other occasions that summer because of solar geomagnetic disturbances, but that he paid no attention when there were no flying discs about to make it noteworthy.



Fig.3 Some similar sighting reports in the Washington area, June 24 1947.
For detail see text.

332 Newton, H. W., 'Council report on solar activity in 1947: Sunspots', *Monthly Notices of the Royal Astronomical Society*, Vol. 108, p.122. <http://articles.adsabs.harvard.edu/full/seri/MNRAS/0108/0000122.000.html>

Clearly these scattered reports do not amount to much evidentially. Follow-up was either non-existent or perfunctory. And none is known to have been placed on the public record in any fashion prior to Kenneth Arnold's story breaking in the newspapers and on the radio. Most of them could, considered alone, be dismissed as sightings of planes, birds, wind-borne debris etc. Nevertheless they are not completely without interest.

The Johnson report in particular retains the distinction of being the first official "unidentified" of the modern era. If the sighting were as "reliable" as the FBI assessed its witness to appear, then it would significantly corroborate several features of Arnold's sighting, including a planform described as approximately round, oval at one end and tapering to a point at the other. This is strikingly reminiscent of Arnold's early July drawings for the AAF, which were circulated privately but are not known to have been published in the newspapers at that date. Johnson could certainly have been influenced by Arnold's early verbal descriptions, of course, which did appear in many papers; but Johnson was by his own account cut-off whilst prospecting in the mountains for some days and would not have been aware of the initial publicity. So it is interesting that his description more closely resembles Arnold's true impression of shape than the symmetrical circular "saucers" which were so well entrenched in the public mind by the date of his August 22 letter to the AAF.

In the report from Bellingham, Washington, earlier that morning, two witnesses saw three fast-flying objects without discernable wings heading south making an unfamiliar sound. They were described as "kite-shaped", which once again is interesting inasmuch the papers of June 27 were full of "discs" and "saucers" but "kite-shaped" would be an apt simile for the objects described and (later) drawn by Arnold (see Fig.4 below, and various Figures, Appendix 4.e)

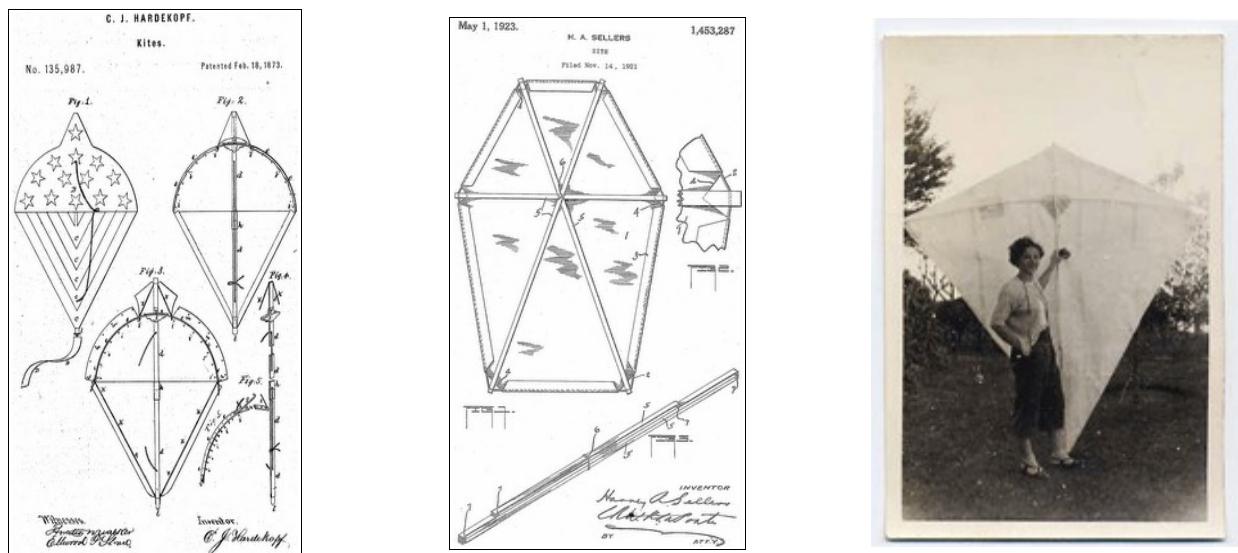


Fig.4 Some kite patents, 1873 and 1923, and a 1947 kite photo.³³³

333 <http://best-breezes.squarespace.com/journal/?currentPage=4>; <http://www.kitepatents.blogspot.com/>

Appendix 4. On the Development of the Arnold Imagery 1947-2010

a) Background The Kenneth Arnold sighting has a unique significance because it is the seminal, defining event in the public consciousness of "flying saucers", and we will never understand their historical origins without a clear and objective answer to the questions of what Arnold said he saw and of how his story was interpreted in the context of the times.

The search for clarity is hindered by the fact that Arnold's descriptions of the objects he saw in June 1947 altered over the years. The history of this change is complicated and the reasons for it difficult to extract. Many accounts in the ufological literature are oblivious of the issue, some merely conflate these different descriptions indiscriminately, whilst others wilfully and selectively exploit one image to the exclusion of another in service to some ideological argument. Why should this confusion have arisen? What ought we to infer from it?

There is a cynical and rather lazy point of view which holds that where inconsistent variations exist in witness narratives this merely serves to prove that testimony is always worthless and can tell us nothing. The history of science clearly shows that this is not so, but it is also clear that human observers are socially-embedded and highly sensitive instruments whose fluctuating outputs need to be calibrated with cunning. This is especially true where the embedding psychosocial medium is as richly evolving and as highly cathected as is the flying saucer mythology. For this reason, where the historical record shows that a witness's statements mutate into explicitly inconsistent forms over time we do normally require a strong justification for giving greater - or even equal - weight to the later forms. Logic and experience tell us that we will normally minimise corruption and contamination if we begin with a presumption in favour of contemporaneous evidence.

This is prudence based on experience. A classic 1954 sighting over Labrador by a highly respected BOAC aircrew including Capt James Howard is a case in point: Recent study has shown that by allowing the documentary record to be corrupted with false witness claims made years after the event ufology disqualified itself from being able to resolve this case. There are two lessons to be learned from this example. The first is that even very impressive, conservative, accurate and well-meaning witnesses can (not "inevitably do", but *can*) fall victim to self-deception and allow their narratives to evolve.³³⁴ The second, at least equally important, lesson is that a witness's contemporaneous evidence can, *despite* later corruptions (not always of his or her own making), be exhumed and proven to be consistent and useful in providing information about interesting phenomena.³³⁵

Arnold's is an extra-special case of this general rule. It is unique inasmuch as his initial sighting report was born naked, as it were. By definition no saucer mythology yet existed. But as time went by, and as the infant story was handed round to be inspected by admirers and detractors, it became swaddled in mythic embroideries and confusions, until in the end Arnold himself apparently disowned his own offspring and rewrote his will in favour of an imposter. We need to understand how and why.

It has become a widely retailed legend that Arnold never described disc-like objects at all, that he originally reported "nine boomerangs" or "crescents" but that a newspaper misinterpreted a description of their motion - "like saucers skipped over water" - as relating to their shape, and thus invented the totally fictitious image of "flying saucers". The journalist responsible has widely been

³³⁴ In Capt Howard's case the most likely reason is an understandable need to preserve self-respect after belatedly coming to realise that his earlier public position - "it was an intelligently controlled machine, not a mirage" - had been a little rash and not really supportable. Some sighting details were changed in late versions, increasing the strangeness.

³³⁵ Shough, M. L., *Study of an Unusual Phenomenon Observed by BOAC Aircrew Over Labrador, Newfoundland, June 29, 1954.*, Sept. 2009 <http://www.martinshough.com/aerialphenomena/BOAC%20aircrew%20sighting.pdf>

identified, even in some quite recent literature, as Bill Bequette, author of the original story that went out on the AP wire from the Portland *East Oregonian* on June 25 1947. The true part of this legend is that Arnold did indeed claim, years later, that he had offered the simile of saucers skipping over water only as a description of the objects' motion. But the rest is a can of worms.

b) Examination Although several different motion similes appear in early published sources, and in Arnold's own Air Force report, it should be noted that the "skipping saucers" image is nowhere among them. The original sources contain other motion similes: "like the tail of a Chinese kite, kind of weaving and going at a terrific speed"; "they flipped and flashed along"; "they flew like many times I have observed geese to fly in a rather diagonal chain-like line as though linked together"; "like fish flipping in the sun"; and "like speedboats on rough water".³³⁶ The claim that they flew "like they take a saucer and throw it across the water" doesn't appear in the record until Arnold offered it 3 years after the sighting in a 'phone interview with radio broadcaster Ed Murrow in 1950:

... when I described how they flew, I said that they flew like they take a saucer and throw it across the water. Most of the newspapers misunderstood and misquoted that too. They said that I said that they were saucer-like; I said that they flew in a saucer-like fashion.³³⁷

If "most" newspapers misquoted him then there should be at least one that didn't. But apparently all of the papers misquoted him. The "misunderstanding" was widespread in the media within a few days and Arnold's story was sought by phone and in person by countless reporters who "came out of the woodwork",³³⁸ so one must assume that he had opportunities to supply clarification. The early press certainly reported Arnold's frustration with how his story was being mistreated. One interviewer said that a "harrassed" Arnold "sighed" about all the "hoopla and hysterics", complaining: "I haven't had a moment of peace since I first told the story . . . This whole thing has gotten out of hand. I want to talk to the FBI or someone. Half the people I see look at me as a combination Einstein, Flash Gordon, and screwball. I wonder what my wife back in Idaho thinks."³³⁹ Nevertheless not a single early source reports Arnold protesting that his use of the word "saucer" had been misunderstood, or reports the statement that they flew like saucers skipped across water; whereas several, including Arnold's own AAF report, *do* contain statements - contrary to Arnold's late claim - that they were saucer-like in shape.

The original press stories were written by Pendleton *East Oregonian* journalists Bill Bequette and Nolan Skiff. The phrase "flying saucers" appears in none of them but was invented by an unknown journalist or editor elsewhere (probably about June 27) on the basis of Bequette's wire stories.

Bequette, the paper's news editor, and Skiff had a first interview with Arnold in the newspaper office about noon on the morning of June 25, after which the intial stories were quickly written. The very first brief story by columnist Nolan Skiff, written just in time to make the bottom of the front-page of that day's issue of the *East Oregonian*, uses the phrase "saucer-like aircraft", proving that right from the start Skiff interpreted Arnold's use of the word "saucer" that morning to be a shape simile:

336 Arnold's 1952 book recalls that he used this last simile "at the time" in 1947: "They flew in a definite formation, but erratically. As I described them at the time, their flight was like speed boats on rough water" (*The Coming of the Saucers* p.11) The earliest published source I have so far been able to identify for the speed-boat simile is the April 1950 interview with broadcaster Ed Murrow, but it may occur in an early press story unknown to me.

337 Radio broadcast of reconstructed telephone interview with Kenneth Arnold by Ed Murrow, April 07 1950. Three days later Arnold was quoted making the same claim in a UP wire story out of his home town of Boise, Idaho.

338 Long, Greg., 'Kenneth Arnold: UFO-Pioneer', *MUFON Journal*, Nov. 1981 p.7

339 'Harrassed Saucer-Sighter Would Like to Escape Fuss,' Boise, Idaho *Statesman*, June 27, 1947

Impossible! Maybe, But Seein' Is Believin', Says Flier

Kenneth Arnold, with the fire control at Boise and who was flying in southern Washington yesterday afternoon in search of a missing marine plane, stopped here en route to Boise today with an unusual story --which he doesn't expect people to believe but which he declared was true.

He said he sighted nine saucer-like aircraft flying in formation at 3.p.m.yesterday, extremely bright -- as if they were nickel plated -- and flying at an immense rate of speed.

Pendleton *East Oregonian* June 25 1947

Bequette had suggested to Arnold that a wire story might shake loose some information about the strange objects which both he and Arnold assumed were some sort of Army Air Force planes or rockets. He wrote a separate short story which he put out on the Associated Press wire that same afternoon. Consistently with Skiff's story it, too, said that Arnold (mistakenly identified as a US Forest Service employee) had described seeing "nine bright saucer-like objects":

PENDLETON, Ore., June 25 (AP) - Nine bright saucer-like objects flying at 'incredible' speed at 10,000 feet altitude were reported here today by Kenneth Arnold, Boise, Idaho, pilot who said he could not hazard a guess as to what they were.

Arnold, a United States Forest Service employee engaged in searching for a missing plane, said he sighted the mysterious objects yesterday at three pm. They were flying between Mount Rainier and Mount Adams in Washington State, he said, and appeared to weave in and out of formation. Arnold said he clocked and estimated their speed at 1200 miles an hour.

Enquiries at Yakima last night brought only blank stares, he said, but he added he talked today with an unidentified man from Utah, south of here, who said he had seen similar objects over the mountains near Ukiah yesterday.

'It seems impossible,' Arnold said, 'but there it is.'

At this point the two journalists went innocently to lunch. When they got back they were surprised to find the office secretary struggling to field telephone calls and messages from all over the country demanding more information. Bequette's AP wire seemed to have stirred up the entire Fourth Estate and he realised that he had misjudged the story's impact, so "I had to hustle down to the hotel, find Arnold, and wring out every last detail."³⁴⁰

Bequette spent a further two hours interviewing Arnold at his Pendleton hotel that afternoon. A follow-up article appeared in the *East Oregonian* the next day, June 26, and was also phoned through to Portland whence it went out on the United Press wire. It naturally contained much more detail, and corrected the error about Arnold working for the Forestry Service; but it did not correct the use of the word "saucer" given as a shape simile in Skiff's article and in Bequette's own earlier AP wire story the day before. The new story not only repeats the simile, but this time puts it explicitly into the mouth of Arnold himself, who is now quoted describing the objects as "saucer-like".³⁴¹

340 'Cub Scribe Broke Story', by James Long, Staff Writer, *Oregon Journal* Oct 17 1975

341 It also contains the phrase repeated in many places by Arnold, "flat like a pie pan" (and, uniquely, the odd phrase "somewhat bat-shaped", which may possibly have been misinterpreted by recent commentators; see later).

Boise Flyer Maintains He Saw 'Em

*Kenneth Arnold Sticks To Story of Seeing Nine Mysterious Objects Flying At Speed
Of 1200 Miles An Hour Over Mountains*

By Bill Bequette

Kenneth Arnold, a six-foot, 200-pound flying Boise, Ida., business man, was about the only person today who believed he saw nine mysterious objects -- as big as four-engined airplanes -- whizzing over western Washington at 1200 miles an hour.

Army and civilian air experts either expressed polite incredulity or scoffed openly at Mr. Arnold's story, but the 32-year-old one time Minot, N.D. football star, clung to his story of shiny, flat objects racing over the Cascade mountains with a peculiar weaving motion "like the tail of a Chinese kite."

A CAA inspector in Portland, quoted by the Associated Press, said: "I rather doubt that anything would be traveling that fast."

Washington, D.C., army spokesman was quoted as saying, "As far as we know, nothing flies that fast except a V-2 rocket, which travels at about 3500 miles an hour -- and that's too fast to be seen."

No High-Speed Tests In Area

He added that there were no high-speed experimental tests being made in the area where Mr. Arnold reported seeing the mysterious objects.

The Boise man, who owns the Great Western fire control supply which handled automatic fire fighting systems, described the objects as "flat like a pie pan and somewhat bat-shaped" and so shiny they reflected the sun like a mirror.

He said the reflection was so brilliant that it blinded him "as if someone had started an arc light in front of my eyes."

Mr. Arnold reported he was flying east at 2:50 p.m. Tuesday toward Mt. Rainier when the objects appeared directly in front of him 25-30 miles away at about 10,000 feet altitude.

By his plane's clock he timed them at 1:42 minutes for the 50 miles between Mt. Rainier and Mt. Adams. He said he later figured their speed by triangulation at "about 1200 miles an hour."

Admits Might Has (sic) Erred

He admitted he might have erred 200-300 miles in his figuring but added "they still were the fastest things I ever saw."

When first sighted, he thought the objects were snow geese.

"But geese don't fly that high -- and, anyway, what would geese be doing going south for this time of year?"

Next he thought they were jet planes. He said he had heard so many stories of the speed of this type of craft traveled so he determined to clock them.

However, he quickly realized "their motion was wrong for jet jobs."

"I guess I don't know what they were -- unless they were guided missiles," he said.

"Everyone says I'm nuts," he added ruefully, "and I guess I'd say it too if someone else reported those things. But I saw them and watched them closely."

"It seems impossible -- but there it is."

Mr. Arnold, who flies 60 to 100 hours monthly throughout five western states, said he was 25-30 miles west of Mt. Rainier, en route from Chehalis to Yakima, when he sighted the objects.

Searching for Lost Plane

He explained that he had been cruising around the western slope of the mountain in hope of seeing a marine corps plane, missing since last January.

"I heard there was a \$10,000 reward offered to anyone who locates it," he added.

He said the "planes" remained visible by the flashes of reflected sunlight for some seconds after they passed Mt. Adams, perhaps for as far away as 50 miles.

Mr. Arnold admitted the angle from which he viewed the objects would make difficult precise estimation of their speed, but insisted any error would not be grave "for that speed."

The DC-4 was closer than the objects, but at 14,000 feet and somewhat north of him. He said he could estimate the distance of the objects better because an intervening peak once blocked his view of them. He found the peak was 25 miles away, he related.

The Boise flyer said they flew on the west sides of Rainier and Adams, adding that he believed this would make it more difficult for them to be seen from the ground.

He said he "measured" the formation by a snow-covered ridge over which they passed and estimated the "train" was five miles long.

Thought Window Was Cause

He said that at first he thought the window of his plane might be causing the reflections, but that he still saw the objects after rolling it down.

He also described the objects as "saucer-like" and their motion "like a fish flipping in the sun."

Mostly, he said, he was surprised at the way they twisted just above the higher peaks, almost appearing to be threading their way along the mountain ridge line.

"No orthodox plane would be flying like that," he commented.

"Ten thousand feet is very low for anything going at that speed."

Mr. Arnold was flying a three-passenger, single-engined plane at 9200 feet at the time, he reported. His speed was about 110 miles an hour.

The Boise man, who is married and has two children, landed here yesterday and said he would remain another day or two before returning to Boise.

He described himself as a "fire control engineer" and emphasized he is not employed by the forest service but is a free-lance contractor.

Pendleton East Oregonian June 26 1947

Bequette also quotes two different motion similes offered by Arnold. Neither of these is the "skipping on water" simile that Arnold much later claimed to have given to Bequette. Instead Bequette first quotes Arnold as saying that their erratic motion was "weaving like the tail of a Chinese kite" and then adds, "He also described the objects as 'saucer-like' and their motion 'like a fish flipping in the sun.'". We should note that Bequette here *explicitly separates* the shape descriptor 'saucer-like' from an associated motion simile (one which Arnold also used elsewhere).

When questioned by sociologist Pierre Lagrange in 1988 Bequette evidently did not remember the "skipping saucer" motion simile; neither did he believe that he had coined the phrase "saucer-like" as a shape simile himself. His original story had placed this phrase in quotes and attributed it to Arnold. But he told Lagrange that it was possible and that he was prepared to give Arnold the benefit of the doubt as to what he had meant.³⁴² However when speaking to author Ronald Story in early 1992 his memory seemed clearer on this point, saying that Arnold *had* used "saucer" as a shape-simile that day. Cognizant that Lagrange had recorded a less explicit answer, Story remarked: "I can only repeat what he confirmed to me: that [it] was based on Arnold's description."³⁴³

The record tends to support Bequette's memory. In addition to the Bequette and Skiff stories there are several other early news sources quoting Arnold in the same terms, including for example further news service wire reports out of Pendleton by unnamed reporters on the 25 and 26 June. One UP dispatch quotes a local businessman to whom Arnold had described the objects as "shaped like saucers":

PENDLETON, Ore., June 26 -- (U.P.)-- Residents of Pendleton sought an explanation today for the nine strange "saucer-shaped" planes an amateur pilot claimed he saw flying at an estimated speed of 1,200 miles an hour across southwestern Washington.

The story was told by Kenneth Arnold, flying fire extinguisher salesman from Boise, Ida. He landed here, slightly bug-eyed, Wednesday and told how he spotted the "extremely shiny nickel-plated aircraft" skimming along at 10,000 feet on Tuesday. Arnold was on a search for a missing Marine corps plane at the time.

"They were shaped like saucers and were so thin I could barely see them," he told Jack Whitman, a local businessman.

Norman (Oklahoma) *Transcript* June 26; see also Cleveland (Ohio) *Press*, Friday, June 27, 1947 and other papers

342 Lagrange, P., 'A Moment in History: An Interview with Bill Bequette', IUR Vol. 23, No. 4, Winter 1998. According to historian Loren Gross (*UFOs: A History*, privately produced, Fremont, Ca., 1988, Vol. 1. p.7), Arnold told Nolan Skiff that the "the 'missiles' travelled like a flat rock bounced across the surface of water, a rising and falling motion." This would be the natural form of such a simile intended only to illustrate motion. It is a commonplace. Everyone has skipped stones, whereas "skipping saucers" is on the face of it a strange and unlikely activity, so Gross's account appears plausible. It is called in question because Gross adds that Bequette used this simile to invent the term "flying saucers" for his AP wire story. He did not. On the other hand, the same expression was attributed to Arnold by Lagrange after having interviewed Bequette: "they look like pebbles [flat stones] or plates: flat, rounded at the front, triangular at the rear" ("On dirait des galets ou des assiettes: plats, arrondis à l'avant. L'arrere triangulaire") (See: Lagrange, P., 'How it All Began', *Anomalies* #3 1997 p.27)

343 Story, R., "Mammoth Encyclopedia of Extraterrestrial Encounters", 2001, p100. But note that Story incorrectly states that this identifies Bequette as "the man who coined the term 'flying saucer'". We can be certain that this is not true, both because of Bequette's explicit disclaimers and because we can prove that the term does not appear in the articles or wire stories written by Bequette. Evidently Bequette was giving to Story the same concession he had offered previously to Lagrange - that, to give Arnold the benefit of the doubt, the phrase "saucer-like" might, rather than being an exact quote, have been Bequette's own, but one "based on Arnold's description [of shape]".

A "special" correspondent for the Chicago *Tribune* filed a story after an interview with Arnold on June 25, quoting Arnold as saying that the objects were "silvery and shiny and seemed to be shaped like a pie plate". There is no mention of plates "skipped over water". The tableware simile appears only for the shape, not motion. As regards motion Arnold is quoted as saying that they "weaved in flight like the tail of a kite" and "went by me like a bullet."³⁴⁴

Of course press stories can be incomplete. The only early source where we can be absolutely certain that we have all of Arnold's own words accurately recorded without loss of context is the KWRC radio interview of June 26 1947. Two things about this broadcast are notable for our present purpose. The first is the background of press activity well-described by host Ted Smith, who indicates that Arnold had been interviewed directly for United Press wire reports by UP staff in Portland and perhaps elsewhere, as was Smith himself:

Well, Kenneth, thank you very much. I know that you've certainly been busy these last 24 hours, 'cause I've spent some of the time with you myself, and I know that the press associations, both Associated Press and our press, the United Press, has been right after you every minute. The Associated and the United Press, all over the nation, have been after this story. It's been on every newscast, over the air, and in every newspaper I know of. The uh, United Press in Portland has made several telephone calls here at Pendleton to me, and to you this morning, and from New York I understand, they are after this story . . .³⁴⁵

Arnold also tells us himself in the interview that he had already given his own story directly to Associated Press, not just second-hand *via* the wire and telephone reports that we know were sent by Bill Bequette on 25 and 26 June. This reinforces our impression of the sort of opportunities that were available for Arnold to correct a press misapprehension directly to the wire services, had it really been the case that he had reported nine "boomerangs". And the second point: In this definitive early source, broadcast on June 26, Arnold does not mention anything about "skipping on water", neither does he correct Nolan Skiff's *East Oregonian* article of the day before attributing to him the description "saucer-like aircraft". He was not obliged to do so, of course; but it was another opportunity to do so, and that he did not take it we can be certain

We also find that Arnold himself used both "saucer like objects" and "saucer-like discs" as shape-similes in his own original Air Force report typed by his own hand (Appendix 1) on or about July 08 1947. Once again, just as important as the fact that Arnold uses these phrases is the conspicuous fact that he does *not* use these terms in the context of any motion simile. Even if previous attempts to correct journalists' misapprehensions had failed - indeed *especially* if they had failed - here was the opportunity, two weeks on, for Arnold to set the record straight first-hand in the most important, official forum. But far from taking the chance to explain that he only mentioned saucers in the first place in order to suggest a skipping motion, Arnold explicitly confirms "saucer" and "disc" as shape similes, whilst in reference to motion he says only that they "flew like many times I have observed geese to fly in a rather diagonal chain like line", and erratically "dipped" or "flipped and flashed in the sun" as they "swerved in and out of the high mountain peaks."³⁴⁶ And even though the shape of the "disk" Arnold drew in this report (and repeated numerous times on carbon copies for other people) was more shovel-shaped or shell-shaped than truly saucer-shaped, with an axial ratio "longer [in the direction of motion] than wide", it most emphatically was not remotely crescent- or boomerang-shaped (which would of course have been wider than long).

Now, there are two early references that are often cited as significant exceptions to the dominant discoidal description. One early newspaper report does use the phrase "crescent-shaped"; another

344 Chicago *Daily Tribune*, June 26 1947 p.1

345 Live broadcast interview with Kenneth Arnold by Ted Smith, KWRC Pendleton, June 26 1947

346 Arnold, K., report to the Commanding general, Army Air Forces, Wright Field, July 08 1947.

quotes Arnold as describing the objects as "somewhat bat-shaped". We will consider these in turn.

The *Oregon Journal*, June 27, said that Arnold "clung stoutly to his story that he saw nine shiny crescent-shaped planes", but these words are not in quotes from Arnold, they are the writer's. Where Arnold is actually quoted in the same article he says, "They were *half-moon* shaped, oval in front and *convex* on the rear. I was in a beautiful position to watch them . . . they looked like *a big flat disk* [emphases added]." This describes the sort of shape Arnold drew for the Army Air Force, a flat plate with a trimmed off or tapered rear edge, and the "half-moon" clearly plays the same role here as the "half pie-pan" in the description used by Arnold elsewhere: "half a pie-pan with a convex triangle in the rear". The shape in Arnold's drawing suggests that he may have had in mind a *gibbous* moon, i.e. between half and full; howsoever the reporter has interpreted "half" to mean "crescent" (in some people's imaginations "moon" and "crescent" might be almost synonymous) and neglected the rest of the description.

The other phrase is to be found in Bill Bequette's second story published in the *East Oregonian* and telephoned to Portland on June 26 (see above). In this case the phrase appears in quotes, and at first sight is more troublesome. Arnold described the objects to Bequette as being "flat like a pie-pan and somewhat bat-shaped". A modern reader whose mind-set is influenced by the crescentic flying-wing imagery which progressively took over during Arnold's later years (beginning with his 1950's claim that just one of the objects had been been a sharp-winged crescent, and ending with the late claim that all nine had been crescent-shaped) tends to interpret "somewhat bat-shaped" as indicating flying mammals of the genus *chiroptera* which would seem to imply wide, extended wings. But one's first impression is frustrated by the fact that Arnold is also quoted in the same interview as saying that the objects were "saucer-like".

The same reader may be inclined to deprecate the latter quote by invoking Arnold's explanation that he had only meant to use "saucer" in the context of a motion simile. But we are obliged to notice the coincidence that when this explanation or justification appears, 3 years late in 1950, it is in the same year that Arnold self-published his pamphlet *The Flying Saucer As I Saw It* showing for the first time an artist's impression of one of the objects as a sharp-tipped, crescent-shaped flying wing - a moment which can be said to mark the start of the transition to Arnold's eventual reinvention of his sighting in the form of nine wraith-like crescents.

Bearing in mind the incongruity of a *chiroptera*-like image among the other descriptions and drawings of June/July 1947, is there another interpretation of that early phrase "somewhat bat-shaped" attributed to Arnold by Bill Bequette? Perhaps. If we grant that Bequette's article may not properly reflect the context of the phrase he quotes, then other possible explanations are that Arnold was referring to baseball bats, table tennis bats and/or aircraft-marshalling signal bats.

When in profile, Arnold said, they showed thin sections, tipping to show planforms tapering to a "little peak at the rear". He described them years later as looking a little "like tadpoles". He might conceivably have likened these tapering profiles to baseball bats. But this is probably the least plausible alternative.

Although table tennis bats are widely known in the US as "paddles" I have found US references to "tennis bats" - both table tennis and (surprisingly) the strung type for lawn tennis that Europeans would call a racquet. One big US distributor advertises on its webpage "rackets, paddles, bats";³⁴⁷ and a US table tennis pundit writes of "bats"³⁴⁸ The largest manufacturing exporter seems to be China, with dozens of companies whose main target market is clearly the US dollar market, and all of them appear to export "tennis bats", not paddles. A table tennis bat, not quite round and with its

347 American Tabletennis, Southfield, Mi., www.americantabletennis.com

348 Lauren Traveau, [Table-Tennis-Equipment---Looking-Through-the-Top-Brands](#)

"tail" edge tapering towards the handle, could well be an apt simile for the objects Arnold described and drew. Fashions change, but we should take account of informed opinion that an American in 1947 would have been much more likely to think of the word "paddle" than the word "bat" in this context.³⁴⁹

Perhaps a more likely allusion for Arnold as an aviator would be to the objects used in aircraft marshalling during that era. These were (as far as I can discover) universally known as "bats", (most famously in carrier operations familiar today from films and newsreels), and the activity was known as "batting". I have not found any references to "paddles" or "paddling" in this context. For example, the website Free Dictionary Online (operated by Farlex, a US company incorporated in Pennsylvania) gives:

*Bat, noun 2. (Engineering / Aeronautics) a flat round club with a short handle, resembling a table-tennis bat, used by a man on the ground to guide the pilot of an aircraft when taxiing.*³⁵⁰

Arnold may have been familiar with these objects and with this practice of "batting" from the ex-Army Air Force flyers that he mixed with as well as from newsreels and general aviation-community scuttlebutt. He may even have seen them.

Of course Arnold did speak later of one wing-like crescent, larger, slightly darker, "a very wraith-like looking thing [that] wasn't round at all" in contrast to the other eight objects.³⁵¹ One might wish to argue that this explains an early use of the phrase "somewhat bat-shaped". But by his own account he did not tell anyone that a ninth object might have differed from his "saucer-like objects" and "big flat discs" (i.e. might possibly have been winglike, crescentic) until saying this privately to the two doomed AAF counter-intelligence officers Brown and Davidson on July 31 1947. Reflecting on this omission when first discussing the matter publicly in 1952 he makes a point of excusing it, explaining that it had been an impression too uncertain even to mention to his wife. This is all thoroughly inconsistent with the theory that he had told the newspapers about a *chiroptera*-shaped crescent wing as early as June 25 1947. Moreover the June 26 quote would imply that *all* the objects were "somewhat bat-shaped". This makes most sense if he meant the implement, rather than the mammal.

Once the story of the (single) crescent emerged, Arnold appears to have maintained it consistently for at least another 13 years. I have a copy of notes made by University of Washington meteorologist Dr. Richard Reed in 1965, apparently of a phone call with Arnold dated March 11 that year, in which Arnold is recorded as saying "Actually, *they* are more like a crescent or half-moon [emphasis added]."³⁵² This may be the first occasion when Arnold is on record seeming to imply in his own (quoted) words that all nine of the objects may have been crescents.³⁵³ But as far as can be determined only in the late 1970s does he begin to publicly and overtly describe all of the nine objects as crescents, and when he does he notably does not ever use the simile of flying bats, but rather speaks of manta rays, rafts, mediaeval axes, wraiths and other things.

It is also worth noting that mammalian bats simply do not resemble the crescent-like shape which Arnold drew for the single object - they fly with wings curved characteristically forward, not

349 Emails to the author from Barry Greenwod & Tom Tulien 27.12.2009

350 <http://www.thefreedictionary.com/BAT>

351 Arnold, K., "How It All Began" in Fuller, Curtis G., *Proceedings of the First International UFO Congress* [1977], Warner, 1980, pp. 17-29

352 Typed notes dated March 11 1965, initialled 'RJR/dm'. R.J.Reed had written about the Arnold sighting in *Weatherwise* in 1958 and corresponded with McDonald during 1966. His notes are in a NICAP file of the papers and correspondence of Dr. J.E.McDonald (courtesy Mary Castner/CUFOS).

353 Or it may have been a statement of the type that a more speculative Arnold often made in later years, generalising about his own several sightings.

scything backwards. Admittedly this is a small point on its own given the existence of highly stylised "bat" imagery such as that connected with the then-popular *Batman* comic franchise that might easily influence such a simile.³⁵⁴ Arnold was not a reader of comics but this imagery would have been widely known. The other side of this same coin, of course, is that even a more nearly discoidal shape, similar to Arnold's Air Force drawing with its trailing edge tapered to a "peak", might conceivably have evoked thoughts of bat-wing shapes for someone exposed to this same stylised imagery.

Another point to consider is that whilst Arnold's instinctive cultural references may well have come from sport (he was a notable athlete) and from aviation, he did describe his youthful interest in birdwatching, and said the objects initially reminded him of a chain of geese. His 1950 flying wing image actually resembles many bird shapes (c.f. the famous pelican; see Section 10.iv) much more than any bat. So if Arnold's intent was to describe objects like this, with geese in mind, one might rather have expected him to say they were "somewhat bird-shaped". That he did not say this could be interpreted to mean that by "bat-shaped" he meant something quite unlike a flying wing - something, as he put it in the same interview, more "saucer-like" or, as he put it elsewhere, like "big flat discs", or indeed something that rather resembled aircraft-marshalling signal bats.

It has been suggested that the image of *chiroptera* was especially apt because it expressed the manner of the objects' flittering flight as well as their shape - which is indeed what springs to our minds today. But if that was his intent, why did Arnold not say that they "flew like bats"³⁵⁵ instead choosing the strangely counter-intuitive simile that they "flew like saucers skipped over water"? Who in real life has ever skipped saucers across water? Who, seeing a bat, has ever thought of describing it as a "disc" or "saucer"? Perhaps Arnold said these things because he saw what appeared to be "big, flat discs" and "saucer-like discs", as he first drew and described them, and because long-winged *chiroptera* would not naturally have come to mind as a simile for these? If we grant that it was possible for Arnold to select a shape-simile which also neatly implied the objects' motion, then of course it was also possible, conversely, for Arnold to select a motion simile which implied the objects' shape, which would be the only sensible interpretation of a motion simile like "saucers skipped over water".

In the end we cannot know for sure what Arnold meant when he said whatever it was he said to Bequette and to other journalists and intermediaries in June 1947, only what was printed, and in one case what was broadcast and recorded. But, however one looks at it, it is hard to avoid the conclusion that the term "saucer" must have been chosen by Arnold to imply something significant about the shape of objects that he also described as featureless mirror-bright "big flat discs" which, whilst not truly circular, were somewhat round.³⁵⁶

Because from 1950 Arnold denied having used the word "saucer" exclusively or exactly as a shape simile, it has been too easily assumed by some commentators that this is the same as a denial that the objects were discoidal. It is not. Arnold apparently never believed or claimed that his objects were *perfectly circular* discs, but his reassertion of this fact is too often presented as though it were equivalent to an admission that he had really meant to convey that the objects were boomerang

354 Email to the author from Barry Greenwood, Dec 28 2009

355 Interestingly a June 28 UP wire dispatch out of Pendleton, Oregon (of unknown authorship), reports a new interview with Arnold and mentions "the strange objects Arnold claims to have seen *batting* through the ozone [emphasis added]". The context here suggests that the author's idiosyncratic understanding of the meaning of "batting" was along the lines of "speeding". One can speculate that this word was in the journalist's mind because Arnold had used it, possibly in the context of the round signalling bats used for "batting" or aircraft marshalling, or possibly to indicate the flight characteristics. But the common meaning of "batting" used as a verb is "fluttering", which is a word that Arnold himself used to describe the objects' erratic jerking.

356 He said that they did appear "completely round" at moments when the sun reflected specularly off their top sides, but the true, slightly eccentric, shape was revealed in silhouette against the snow (letter to the Commanding General, Wright Field, July 08 1947).

shaped. There is no evidence in any early sources that this was so. Instead, a preponderance of evidence shows that he was prompted to use the word "saucer" *at least in part* as a shape simile for his "big flat discs".

c) Interpretation It is rather well documented (see Appendix 4.e) that over the course of some 30 years published versions of Arnold's story did evolve away from this discoid description and towards crescents. The psychosocial factors at work here are not immediately obvious and can only be uncovered by examining the detailed history, but one important factor appears to be that this adaptation occurred with Arnold's own later complicity and even encouragement. Why should this have happened? What can it tell us about Arnold's own beliefs and motivations?

Firstly, given the conclusion of Appendix 4.b above, how surprising, or otherwise, were flying discs in the context of the times? Is it to be expected that a person like Arnold would tend to think of experimental aircraft as disc-like?

I am aware of no evidence of any strongly normative social pressures tending to enforce perception of discoidal aircraft in June 1947. At that time images of approximately-discoidal aircraft were not totally unknown. A speculative item about a circular-wing aircraft design had appeared in print in the pulp magazine *Amazing Stories* in 1946. A few of the hundreds of imaginative spaceships of all shapes depicted in cover art for *Amazing* and similar publications during previous decades did have discoidal symmetry. But Arnold, according to his own account, had no familiarity at all with sci fi and fantasy magazines, and certainly did not interpret his sighting in such a context. He thought he had seen experimental "aircraft" or perhaps "missiles" of the AAF. The idea of disc-like aircraft did exist on the fringe of the aeronautical world. The magazines *Science et Vie* in France and *Mechanix Illustrated* in the US had both carried cover pictures of the USAF's abortive XF-5U experimental plane - the heel-shaped "Flying Flapjack" - during the previous year. But there is no evidence that Arnold had heard of these ideas at the time, still less that he was influenced by an interest in them.

In contrast to this, flying wing designs were more than a fringe idea and a fond hope - they were an engineering reality, developed in several forms in the US by ex-Lockheed designer Jack Northrop since 1939 (from a concept pioneered by Northrop in 1929) and famously in Nazi Germany by (among others) the Horten brothers, whose designs had been the subject of much interest by Britain and the US in the immediate post-war period. The image was far more widely disseminated in the popular culture. Indeed one witness (a Forestry Service look-out in the Cascades who saw a line of bright somethings on the same day as Arnold; see Appendix 3) thought it prudent to emphasise to journalists that what he saw "was not the flying wing"; whereas Clyde Homan, manager of a tulip-growing business who along with his farm foreman saw nine similar objects undulating and giving off sun reflections as from bright metal near Woodland, Washington on June 27, "ventured the opinion the objects might have been the new type of tail-less aircraft known as flying wings", although he could not make out a shape behind the bright reflections except that they were "very flat and very, very thin".³⁵⁷ A 3-page illustrated spread on the Northrop XB-35 had appeared in the Jan 1947 issue of the widely-read magazine *Popular Science*. It would probably be fair to say that the flying wing was the iconic image of futuristic aviation in post-war America.

(A randomly assembled list of examples of popular imagery representing both flying wings and flying discs pre-June 1947 is given in Appendix 4.d.)

If Arnold's sighting had been influenced by notions of what advanced planes ought to look like in June 1947 then one would expect his report to have emphasised features of flying wings rather than of flying discs. And there *are* features of Arnold's early verbal description that, lifted out of context, can be interpreted as suggestive of flying wings. He spoke of the objects' "wing or whatever it was"

357 'Are They Jet Propelled? Oregon Man Sights Disks at Close Range', *Oregon Daily Journal*, June 28 1947

and emphasised that what especially puzzled him about their shapes was that he "couldn't find any tails on them". If we ignore talk of saucers and discs, and if we ignore also Arnold's own drawings, with their annotation saying that the flat discs were "longer than wide", then his description of "half a pie-plate with a convex triangle in the rear" could also be interpreted as a kind of flying wing (wider than long) with a small "triangle" being a sort of vestigial fuselage, and from this we could get to Arnold's post-1950 image of the sharp-winged crescent. Is it possible that these details are, as it were, fossils of Arnold's true first impression, preserved inside a more discoidal image which Arnold improvised during the first weeks as he subtly adapted his story to conform to popular expectation?

It is understandable that there may have been a cultural pressure in this direction, and one can point to individual influences. Arnold's discoidal sketch in his Air Force letter must have been drawn after the July 04 United Airlines case which is referenced in the letter. By July 04 the "flying saucer" or "flying disc" stereotype is becoming well established everywhere, and Capt E. J. Smith - an impressive and influential witness with whom Arnold closely allied himself in his appeals to the Army Air Force to take the saucers seriously - had that day seen nine "discs" described as "circular, flat on the bottom and rough in top, bigger than our [DC-3] aircraft" silhouetted against the Idaho sunset. So here we have a theory: Perhaps in Arnold's post-July 04 sketch an original, more ideoyncratic impression of a tail-less flying wing was morphing towards a "saucer-like disc" because this stereotype was taking over the public imagination and had even influenced Capt Smith, regarded by Arnold as "probably the most highly thought of and respected veteran pilot that flies the air lanes".³⁵⁸ Perhaps Arnold was motivated by wanting to hang onto the coat tails of "Big Smithy" and borrow the support of the growing number of other "saucer" eyewitnesses around the country?

But this suggestion seems out of character for Arnold, who was no meek hanger-on but rather a tall, well-built and capable self-made man with a healthy opinion of his own worth. He gives the impression of sticking stolidly to his guns in the midst of speculation and ridicule. Character testimonials from Army Air Force Counter-Intelligence Corps agents, journalists, aviation professionals and others who knew and/or interviewed him paint a picture of a self-reliant and forthright man not inclined to tell people what they want to hear (see Section 11). The theory that in the first couple of weeks he transformed flying wings to flying discs to ally himself more closely with a popular "flying saucer" craze is not very consistent with the character and actions of a man resentful of being characterised as a "screwy" and who complained, "I haven't had a moment of peace since I first told the story . . . This whole thing has gotten out of hand. I want to talk to the FBI or someone."³⁵⁹

This invites us to consider an alternative scenario in which Arnold perhaps tended to revise an original quasi-discoidal description in the other direction, away from an image increasingly associated with wild speculation and towards more aeronautically-credible flying wings, by increasingly emphasising those features which had distinguished their shapes from true discs and/or suppressing explicit statements that might have suggested circular symmetry. Arnold certainly had motivation. His initial efforts to get the AAF and FBI to take him seriously seemed to be frustrated, and he expressed disappointment about this in his original AAF letter and in a telex of July 12 1947 to the Public Information Officer, Wright Field. Official reticence may have increased his aversion to being publicly associated with saucer-sighters whom the newspapers too often portrayed as nuts and kooks.

A tendency to seek the endorsement of conservative military authorities would be consistent with the fact that when Arnold was exposed to the William Rhodes photo by Army CIC officers Brown and Davidson on July 31, and was (he said) told that the AAF regarded it as genuine, he suddenly

358 Arnold, K. & Ray Palmer, *The Coming of the Saucers*, Amherst Press, Wisconsin 1952, p.17

359 'Harrassed Saucer-Sighter Would Like to Escape Fuss,' Boise, Idaho *Statesman*, June 27, 1947

remembered a fact that he had never mentioned before - that one of his objects had looked just like it. It would also fit the way the explicit descriptions and drawings that are part of the public record prior to this date give way later to vaguer and more evasive descriptions. His 1950 pamphlet "The Flying Saucer As I Saw It" and his 1952 book are both notable for a reluctance to be verbally explicit about shape, and both allow the image of a sharp-tipped crescent wing to stand alone as representing *at least* one and possibly - but only by tacit implication at this stage - all of the objects.

Arnold told the Army Air Force that he had spoken with former wartime AAF fliers who had been alerted about radical jet designs that they might encounter in the European theatre - an apparent reference to experimental Nazi aircraft. And Arnold was quite proactive in pursuing the mystery of his sighting (*vidé* his activities in the Maury Island affair and contacts with the AAF), which raises the possibility that Arnold might have become aware soon after June 24 of rumours of possible recovered Nazi designs. Could he have learned or guessed that these designs included flying wings of interest not only to US engineers hoping to build on the initial promise of the Northrop XB-35 flying wing (see Appendix 4.d) but also to the Russians?

The idea would feed into his belief that he saw secret AAF planes or rockets. He could well have come to believe that this was the only reasonable explanation for the AAF's reluctance to investigate. And a flying wing could have been the image in his mind when he began "adjusting" his recollection of the the objects' shapes towards something aeronautically plausible that he knew the AAF would be more inclined to take seriously.

For a man of Arnold's character, who thought of himself as one of a community of no-nonsense mountain aviators and whose daily millieu was other fliers some of whom were ex-Army, a desire to court the respect of conservative authority figures in the military is somewhat more psychologically plausible than a desire to reinforce a media reputation as "Mr Flying Saucer", and such a desire could have influenced him to morph the shapes of his objects progressively towards flying wings, *via* the "genuine" Rhodes photos authoritatively shown him by Army CIC agents Brown and Davidson (which Arnold appears to have interpreted as perspective projections of a crescent-shaped planform).

In summary this hypothesis has several things to recommend it:

- it would be consistent with Arnold's character, his self-image and his millieu;
- it would be consistent with the prominence of the flying wing both as the practical cutting edge of contemporary aviation and as an image of the future of revolutionary flight;
- and it explains not only the direction of the trend in the development of the early imagery from nine discs to eight discs plus one crescent form, but also the direction of the trend within the crescent imagery in later years, from one crescent to nine crescents.

The alternative is that Arnold initially believed he saw nine crescents but subsequently told the Army Air Force, Army Counter Intelligence and the FBI that they were discoids in order to fall in line with the cultural predominance of a "disc" (saucer) motif invented mistakenly by journalists. This really does not fit either the psychosociology of the moment or the historical documentary evidence.

It appears that Arnold really did originally report what could be fairly described as distorted saucers, which he himself described as "saucer-shaped", "saucer like" and "big flat discs", not exactly circular like mother's crockery but (as he drew them multiple times) somewhat round shapes that had "looked perfectly circular" when seen by the reflection of the sun off their mirror-like tops, but

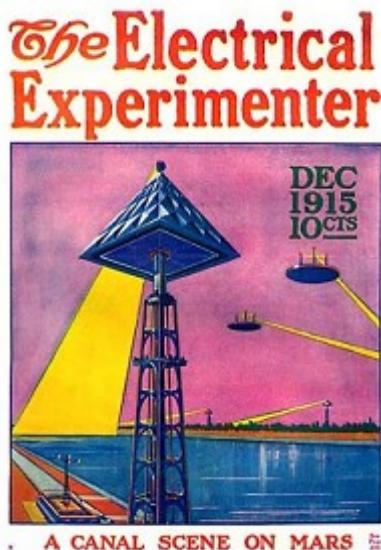
which were revealed as roughly shovel-shaped or scallop-shaped (paddle- or "bat-shaped") when "observed quite plainly" in black silhouette against the snow, having a very shallow, dished cross-section when seen edge on.

There's little doubt that Arnold really did believe he'd seen experimental disc-like aircraft as he claimed at the start. Later he began to distance himself further and further from the popular notion (a tendency for which we can cite motive), eventually falling into a kind of symbiotic mythopeia with a strand of sceptical ufological revisionism which embraced for its own purposes his final denial that he had ever reported anything even approximately like discoidal machines.

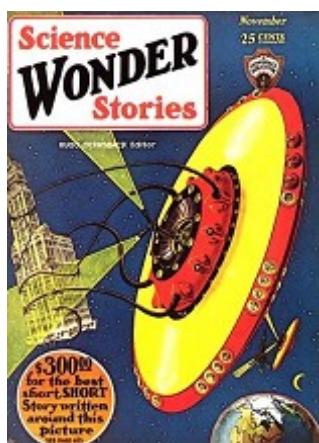
His sighting and the culture it created transformed Kenneth Arnold, and his story along with him, into part of the myth, to the point where 30 years later he was remembering his encounter with nine crescent-shaped, mind-reading, sentient, glowing, wraith-like space-animals (see Appendix 4.e). But on June 24 1947 he was just an ordinary guy in a plane who saw some fast flying objects and we have to keep reminding ourselves not to forget that.

d.) Flying Discs and Flying Wings; Some precursors of 1947 Arnold imagery

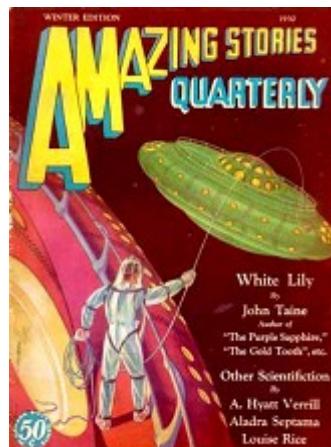
1) December 1915 *The Electrical Experimenter*



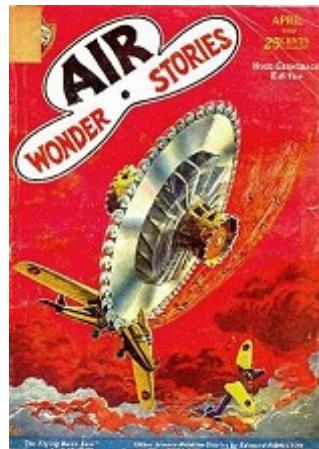
2) November 1929/1930 *Science Wonder Stories*



3) Winter 1930 *Amazing Stories Quarterly*



4.) April 1930 *Air Wonder Stories*



5) June 1933 *Modern Mechanix*



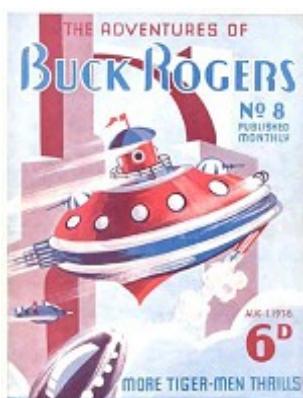
6) July 1934 *Modern Mechanix* 'Flying Wing is Air Liner of Future'



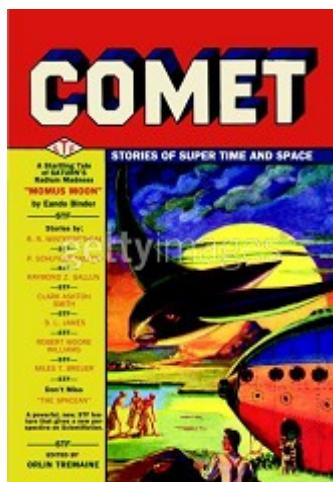
7) July 1936 *Modern Mechanix*; 'Odd-shaped Flying Wing is Model for Proposed Sky Liner'



8) 1938 *The Adventures of Buck Rogers* #8



9) 1940 *Comet; Stories of Super Time and Space*



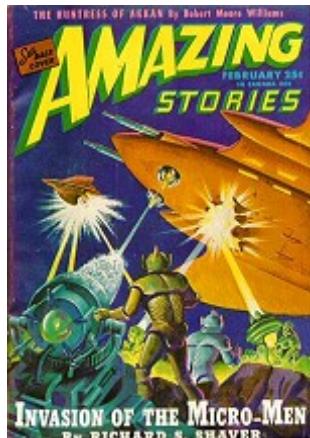
10) June 1942 *Amazing Stories*



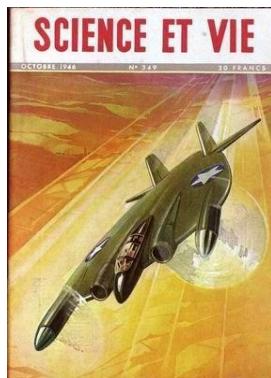
11) Second World War, U.S. magazine advert (title unknown)



12) February 1946 *Amazing Stories*

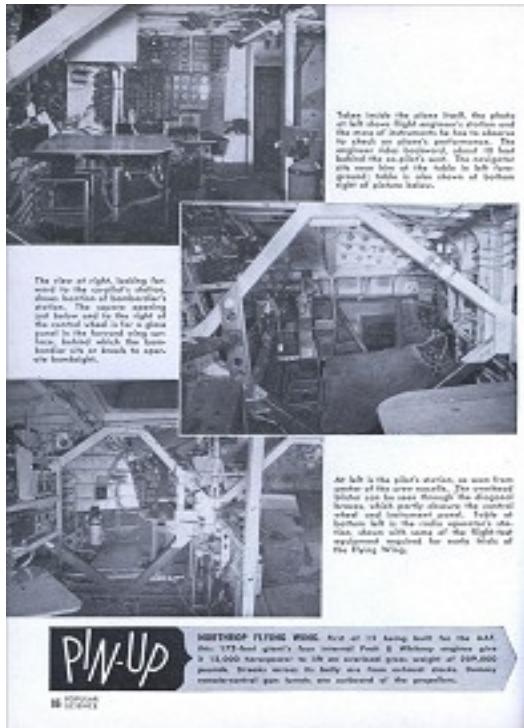


13) October 1946 *Science et Vie* (France) impression of US Navy experimental XF-5U1 "Flying Flapjack".



14) January 1947, 'Inside the Flying Wing' *Popular Science*



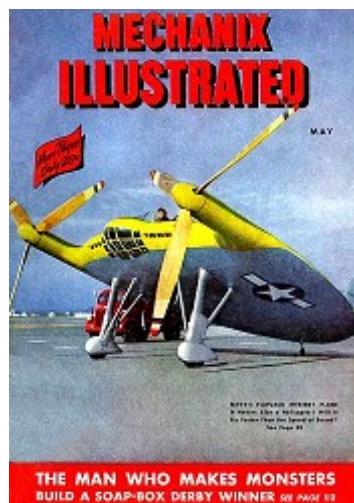


PIN-UP

NORTHROP FLYING WING. And off it goes! Built for the R.A.F. the T73-1000 pound's first flight was made on April 2. Whiteman's wings give it 11,000 miles range, 100 mph maximum speed and a load of 20,000 pounds. Struts across its belly are from aircraft stocks. Dummy meteorological gear stands on either side of the propellers.

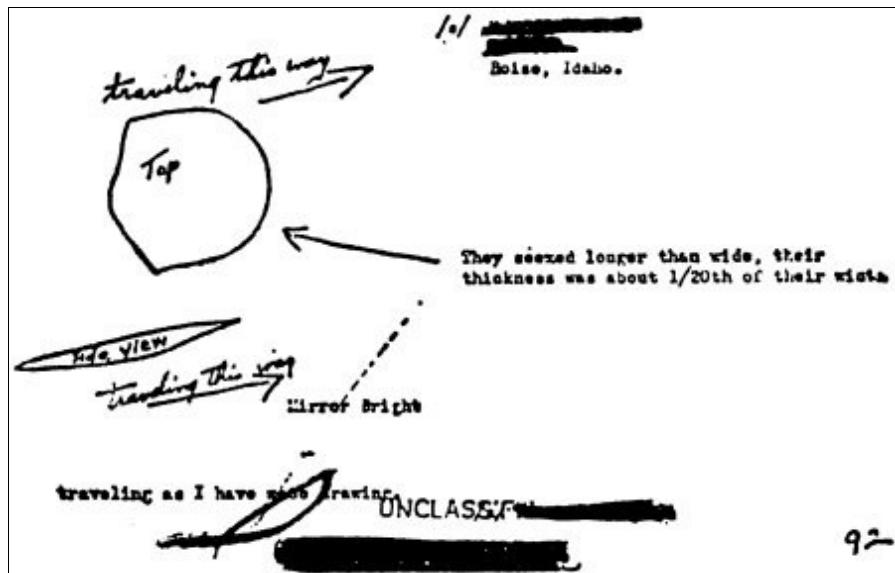


15) May 1947 Mechanix Illustrated Navy XF-5U1 Flying Flapjack

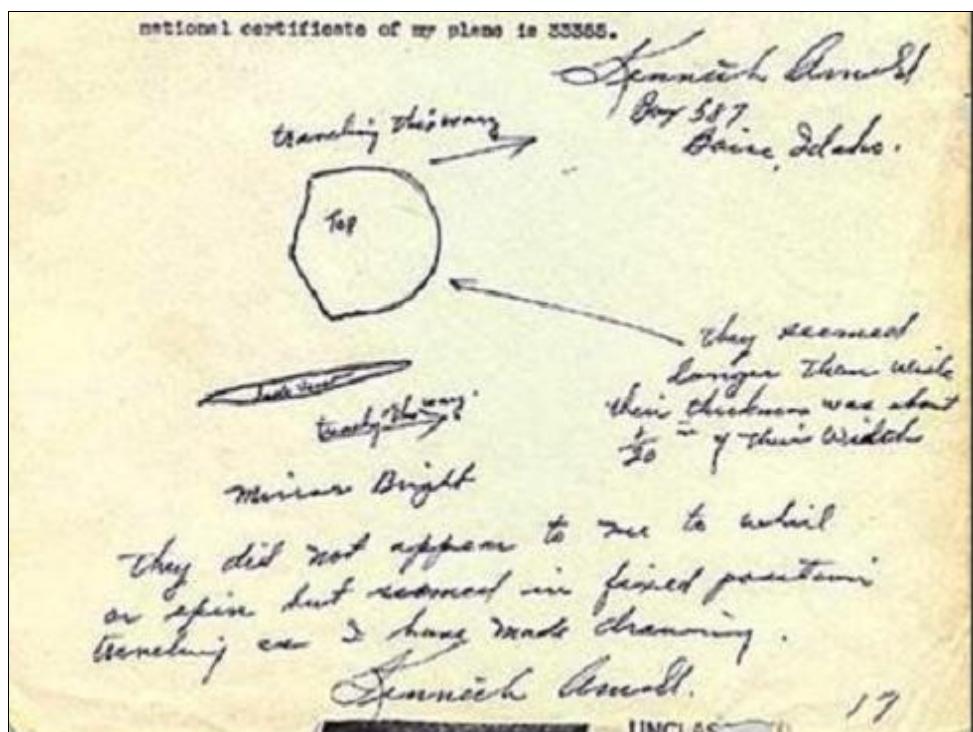


e.) Tentative timeline of Arnold imagery

25 June - 12 July 1947. Numerous early sources including Arnold's broadcast words and his own drawings sent to the AAF describe 9 flat but not-quite circular objects which he says he was able to observe "quite plainly", all of the same specific shape but with no discernable surface feature. Earliest verbal description is of "half a pie-pan" (or a "half-moon") stuck onto a "convex triangle". Earliest drawings show a flat, thin, roughly discoidal wing, slightly longer than wide, cut to a taper at the tail. Early descriptions quoted from Arnold include "saucer-like", "saucer shaped" and "big flat disc". Arnold chose the terms "saucer like objects" and "saucer like discs" in his own report to the Army Air Force Wright Field (typed sometime prior to 8 July 1947)

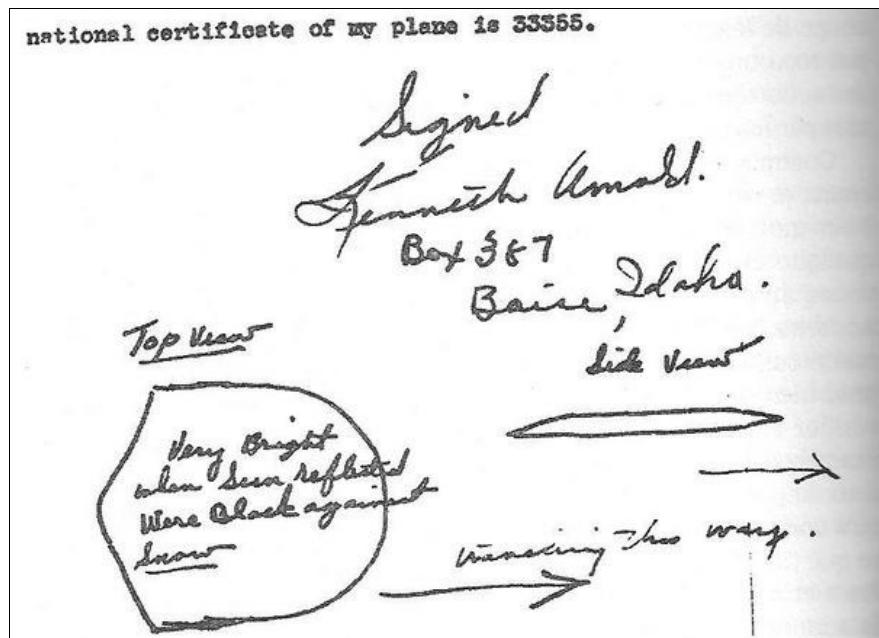


92



17

national certificate of my plane is 33355.



Above are three versions of Arnold's drawings appended to copies of his early sighting report typescript

Arnold's written statement and drawings are reinforced by this Air Force Project Sign "checklist" form (detail, below), p.18 of the Incident #17 file in the NARA collection:

- | | | |
|-----|-----------------------|------------------------------|
| 15. | Sound | E/S |
| 16. | Size | Approximately that of DC-4 - |
| 17. | Color | mirror like |
| 18. | Shape | Approximately circular |
| 19. | Odor detected | E/S |
| 20. | Apparent construction | E/S |

Possible early erratics:

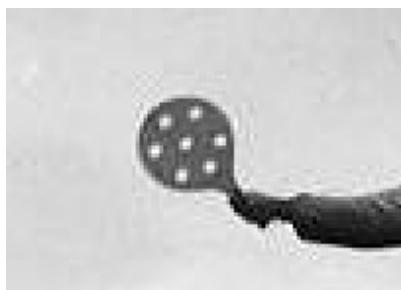
- 1) June 26 1947. The Pendleton, Oregon, *East Oregonian* newspaper quotes Arnold: 'The Boise man . . . described the objects as "flat like a pie pan and somewhat bat-shaped" and so shiny they reflected the sun like a mirror.'

NOTE: The phrase "somewhat bat-shaped" today usually brings to mind winged mammals of the genus chiroptera, but this image is incongruous among Arnold's other early drawings and descriptions. There is arguably a disconnect between this image and the "pie-pan" simile used by Arnold in the same sentence. Other possible explanations are that Arnold was referring to baseball bats, table tennis bats and/or aircraft-marshalling signal bats.

When in profile they showed long, thin, tapering sections. He described them elsewhere as looking a little like tadpoles. Arnold could have likened the profiles to baseball bats. Alternatively, although table tennis bats are widely known in the US as "paddles" I have found US references to "tennis bats" - both table tennis and (surprisingly) the strung type for lawn tennis that Europeans would call a racquet. A big US distributor of European imports is American Tabletennis, Southfield, Mi., who advertise on their front webpage "rackets, paddles, bats". The largest manufacturing exporter seems to be China, with dozens of companies whose main target market is the US dollar market, and all of them appear to export "tennis bats", not paddles.

But perhaps a more likely allusion for Arnold as an aviator would be to the objects used in aircraft marshalling during that era. These were (as far as I can discover) universally known as "bats" , (most famously in carrier operations familiar in films and newsreels), and the activity was known as as "batting". For example, the website Free Dictionary Online (a US-based site) gives:

bat, noun 2. (Engineering / Aeronautics) a flat round club with a short handle, resembling a table-tennis bat, used by a man on the ground to guide the pilot of an aircraft when taxiing



I have not found a reference to 'paddles' or 'paddling' in this context. I think Arnold may have been familiar with this practice and with these objects from the ex-Army Air Force flyers that he mixed with as well as from newsreels and general aviation-community scuttlebutt - possibly even from having seen them.

We cannot know for sure what Arnold meant when he said whatever it was he said to the East Oregonian but what seems to spring naturally to our minds now (because of the associations we have formed during the decades in which Arnold's description itself evolved) is incongruous in the surrounding context of other descriptions and drawings by Arnold during this period - the trimmed-off discoids "somewhat longer than wide" (as opposed to wings, wider than long).

Of course Arnold spoke later of one wing-like crescent. But by his own account he did not tell anyone that a 9th object might have differed from his "saucer-like objects" and "big flat discs" (i.e. might possibly have been winglike, crescentic etc) until saying this privately to the two doomed AAF officers Brown and Davidson on July 31 1947. Reflecting on this omission in 1952 he makes a point of excusing it, explaining that it had been an impression too uncertain even to mention to his wife. He would hardly have said this if in fact he knew that he had told the newspapers about a bat(chiroptera)-shaped crescent as early as June 25 1947.

And although Arnold did, some weeks later, claim that one of the nine objects had not been discoidal, the June 26 quote is characterised as applying to all of the objects, implying that all nine were "somewhat bat-shaped". In June 1947 this would have made no sense if he meant the mammal, but it would have made sense if he meant the implement.

Moreover, once the story of the (single) crescent emerged, Arnold maintained it consistently for nearly 20 years. I have a copy of notes made by McDonald in 1965, apparently of a phone call with Arnold, in which Arnold is recorded as saying "Actually, they are more like a crescent or half-moon.". But AFAIK only in the 1970s does he begin to publicly describe all of the nine objects as crescents, and when he does he notably does not ever (in any findable sources) use the simile of flying bats, but rather speaks of manta rays, mediaeval axes, wraiths and other things. It is also worth noting that mammalian bats simply do not resemble the crescent shape which Arnold drew for the single object - they fly with wings curved characteristically forward, not scything backwards. (Yes, one could describe his crescent as shaped "somewhat like a single bat wing" but that isn't what Arnold is quoted as saying).

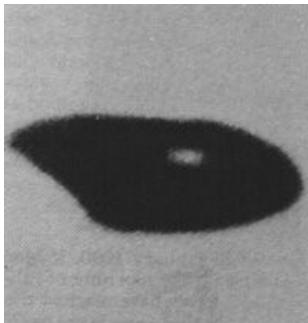
Arnold's natural cultural references may well have come from sport (he was a notable athlete) and from aviation. But outside these areas, he did say he'd had a youthful interest in birdwatching, and said the objects reminded him of a chain of geese. His crescent shape actually resembles many bird shapes (c.f. the famous pelican; see Section 10.iv) much more than any bat. So why did he not rather say they were "somewhat bird-shaped"? Perhaps because they looked neither like birds nor like chiroptera but were, as he put it in the same interview, "saucer-like" or, as he put it elsewhere, like "big flat discs".

It has been suggested that the image of chiroptera aptly expressed the manner of the objects' skittering flight as well as their shape - which is indeed what springs to our minds today. But if that was his intent, why did Arnold not say "they flew like bats", instead choosing the strange counter-intuitive simile that they "flew like saucers skipped on water" (who in real life has ever skipped saucers across water?), not 'they flew like bats'? Perhaps because they appeared to him to be "big, flat discs" and "saucer-like", as he first drew and described them, and because long-winged chiroptera would not naturally have come to mind as a simile for these.

- 2) Another paper, the Oregon Journal, Pendleton, June 27, says: Arnold "clung stoutly to his story that he saw nine shiny crescent-shaped planes..."

NOTE: But the words "crescent-shaped" are the journalist's, not Arnold's; Arnold is quoted here in his own words as saying "half-moon shaped", which relates to the use of "half moon" as an alternative to "half a pie-pan" in the other descriptions, as is made clear in context: 'They were half-moon shaped, oval in front and convex on the rear. I was in a beautiful position to watch them . . . they looked like a big flat disk'. The phrase "big flat disk" and a "convex" trailing edge suggests that Arnold may have actually meant "gibbous moon" rather than "half moon". Howsoever a careless conflation of the phrase "half-moon" with the term "crescent [moon]" may point to the explanation of where the first crescent image originated, perhaps aided by Arnold's ambiguous "bat-shaped" simile and the Rhodes photo affair . . .

7 July 1947. Wm. Rhodes in Phoenix, Arizona, produces two photographs of a heel-shaped object with a central spot or hole. In an interview with Counter Intelligence Corps Special Agent George Fugate, Jr. (August 29 1947) Rhodes described the object he had seen and photographed, comparing the plan shape to the Navy's experimental 'Flying Flapjack' (below, right) but noting the absence of propellers or landing gear



(left) One of the Rhodes photos from Phoenix, Arizona

(right) The Navy XF-5U1 or "Flying Flapjack" had appeared on the cover of the May 1947 'Mechanix Illustrated' (see above). Only one built, flown at Bridgeport, Connecticut, then scrapped



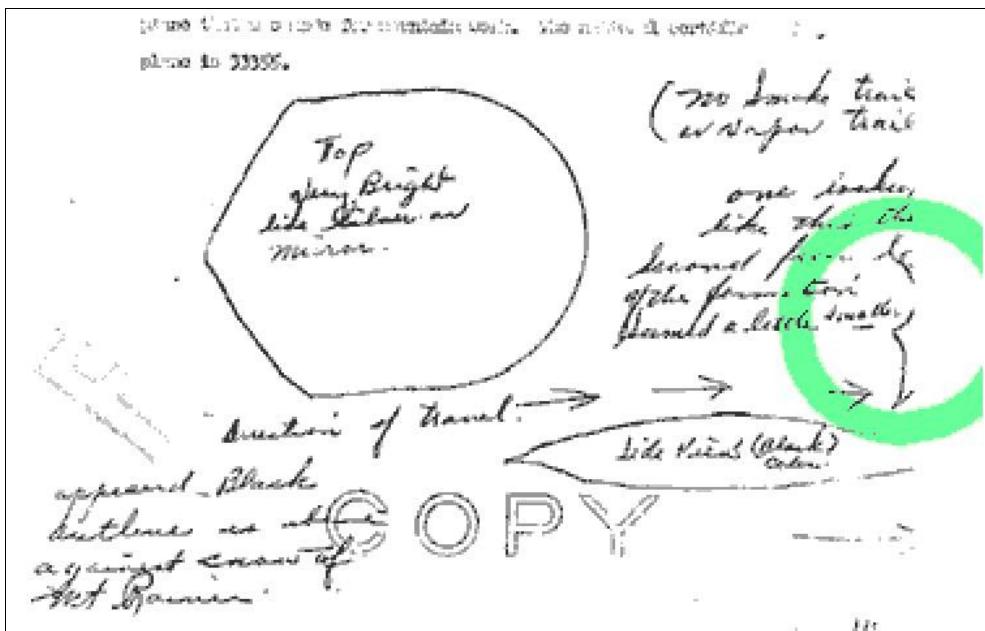
29 July 1947. According to his later testimony, on this day Arnold sees a formation of small flying objects with an initial resemblance to "ducks" but which flew too fast. Each appeared "brass-coloured" with a bright or dark "spot" in the middle

31 July 1947. Capt Davidson draws the heel-shaped Rhodes object for Arnold in Seattle, telling him the AAF regarded these photos as "genuine". According to his own later testimony (*The Coming of the Saucers*, 1952), Arnold then acknowledges explicitly, for the first time, that he really saw only 8 objects of the earlier-described shape, and a 9th of a shape "almost identical" to the Rhodes object.

19 August 1947. A drawing by Arnold (below) shown in an article by Joel Carpenter at <http://www.project1947.com/gr/grchron3.htm> is captioned as follows:

'Kenneth Arnold sketch of his objects - sent to AMAZING STORIES editor Ray Palmer on July 29, 1947. On right edge, cut off in this FBI copy, is the tail edge of "object number eight," the second-last object of the formation, which was bat-winged and "a little smaller" than the main "saucers," according to Arnold ("FBI UFO FOIA document file")'

According to a similar claim by Pierre Lagrange, July 29 1947 was when Arnold made the first drawing showing a "crescent" (oral communication from P. Lagrange to J-P Pharabod, 22 Jan 1998). However, so far as the author can determine it remains unclear if this claim has any independent basis (Lagrange was unresponsive to emails). The known drawing below appears to have been done for the FBI about 19 August 1947.



Drawing by Arnold on a *carbon* of his July 1947 typescript showing a crescent-shaped 9th object (highlighted, leading edge trimmed off on document) provided to the FBI at an interview on Aug 19 1947

NOTE: The dating of this drawing is far from being obvious and needs careful thought. The drawing can be found on p.67 of this FBI file:

<http://foia.fbi.gov/ufo/ufo4.pdf>

The source of the claim that Arnold drew a crescent on July 29 1947 is evidently a copy of a letter in this file from Arnold to Palmer dated July 29. This letter is associated in the file with the copy of Arnold's familiar article bearing the above drawing. But the date is probably misleading.

in which [redacted] attempts to encourage Mr. [redacted] to continue his investigation to the flying discs. This letter is also being enclosed to the Bureau.
Mr. [redacted] also gave SA [redacted] a copy of the article sent to Mr. [redacted] and to the Commanding General, Wright Field, Dayton, Ohio, regarding his sighting of the nine discs near Mount Rainier on June 24, 1947. This article is also [redacted] b
being enclosed to the Bureau. [redacted] advised that he is vitally interested

Detail from report of FBI SAC, Butte, on Aug 19 1947 interview of Kenneth Arnold, Aug 27 1947, listing enclosures: "Mr [Arnold] also gave to SA ---- a copy of the article sent to Mr [Palmer] and to the Commanding General, Wright Field, Dayton, Ohio, regarding his sighting of the nine discs near Mout Rainier on June 24 1947. This article is also being enclosed to the Bureau."

The FBI agent's (Special Agent in Charge, Butte office) report on his interview with Arnold encloses documents obtained from Arnold in Boise on Aug 19. The agent states "Mr [Arnold] also gave to S[pecial]A[gent] --- a copy of the article sent to Mr [Palmer] and to the Commanding General, Wright Field, Dayton. Ohio, regarding his sighting of the nine discs near Mount Rainier on June 24, 1947. This article is also being enclosed to the Bureau."

Note, "a copy of the article sent to Mr [Palmer] and to the Commanding General". Clearly this does not mean that the drawing is a facsimile of the drawing on the copy sent to Wright Field - we know it is not, since we have the latter in the Air Force file and it differs markedly. So why should we think it means that the drawing is a facsimile of the drawing on the copy sent to Palmer? We shouldn't, and it doesn't.

In 1947 copier technology was not easily available. Mechanical duplicators like the mimeograph and the spirit copier existed, but these required the production of a master or stencil using specialised media at the outset. They were not image copiers. Photostat and other wet chemical processes were cumbersome, messy and expensive. The first Electrofax electrostatic copiers began to appear in the early 1950s. What would later be known as Xerograph technology (xerox) was in early development in 1947, but the company did not yet even exist. You could not go into a shop in Boise, Idaho, and order up facsimiles of a document, still less do it at home or in your office. The FBI would have had access to equipment for producing facsimiles of paper images. But not Kenneth Arnold.

Arnold gave the FBI agent two letters from Palmer to himself, Arnold's article with the drawing, and also Arnold's covering July 29 letter sent to Palmer with a copy of the article. And this letter is evidently the document which has been assumed hitherto to prove the date of the drawing on the article.

Obviously this last was not the typed original sent to Palmer in 1947, which was no longer in Arnold's possession. Neither could it have been a xerox or photocopy in 1947. It was a carbon. The same is true of the article itself. Arnold told us in 1952 that he sent Palmer a "carbon copy" of his report to Wright Field. We know from the multiplicity of versions that Arnold circulated a number of such copies, and added the drawings by hand.

This is consistent with the appearance of the document in the FBI file (as seen in PDF). The quality of the typescript of both the article and the covering letter is faint and broken, the legibility varying cyclically down the page in a way that is typical of copies made with previously-used carbon sheets in the rollers of a typewriter.

On the carbon of the letter (copied, probably photostatically, by FBI for this file copy which has the word "COPY" stamped on it) appear two separate handwritten annotations by Arnold, one at the top of the sheet, one at the bottom. The top one says "This is a copy of the same article I sent to the Commanding General, Wright Field, Dayton, Ohio." Then follows Arnold's typed short letter to Ray Palmer, and at the bottom is another very similar handwritten annotation saying, "This copy is the same as I sent to [blacked out]". The name blacked out (by the FBI) is obviously "Raymond Palmer", and this declaration was made by Arnold for the information of the FBI, as recorded by Special Agent --- in his report:

"Mr [Arnold] also gave SA --- a copy of the article sent to Mr [Palmer] and to the Commanding General, Wright Field . . . This article is also being enclosed to the Bureau."

So we can be almost certain that this drawing was not done on July 29 and was not a drawing sent to Ray Palmer; but was rather a drawing done on or about Aug 19 for the FBI SAC when the latter visited Arnold in Boise for interview. It was drawn on another carbon copy of the same typed article, copies of which had been sent to the AAF on or about July 8, to Palmer on July 29, and to others on other dates - each bearing (as we have already discovered) drawings that are similar but not identical, the reason for this being simple - Copying was effectively non-existent in 1947 and so drawings had to be added by hand at different times by Arnold to each text copy as required.

He stated he flew to Seattle and got ██████████ and that Lieutenant ██████████ and Captain DAVIDSON had come to his room about 4:00 P.M. ██████████ advised that he had asked Lieutenant BROWN just what he had found out regarding the discs, and Lieutenant BROWN had confidentially informed him that they had obtained a picture of a disc, which appeared to be authentic, which picture was taken by a man in Phoenix, Arizona. The picture, according to Lieutenant ██████████, was of a circular object with a hole in the center, and of another object that looked like a flying wing. He stated that when Lieutenant BROWN told him this that he immediately thought of the object seen by DAHL. He stated that after hearing ██████████ story, Lieutenant BROWN and Captain DAVIDSON's attitude / ...

Another detail from the report on the FBI interview of Kenneth Arnold, Aug 19 1947. Arnold told the Agent that Lt Brown described the Rhodes photo to him as showing "a circular object with a hole in the middle" and "another object that looked like a flying wing". This statement indicates a context for Arnold's drawing of the "crescent" as provided to the Agent at this interview

This is a convincing proof that the copy of Arnold's article that Palmer took out of the envelope on July 30/31 1947 did not, and could not, have contained this drawing of a crescent. It could hypothetically have contained another different drawing of a crescent, but I know of no evidence that it did, and I would not expect to find evidence because it would be inconsistent with other parts of the record, i.e.:

Arnold wrote that he hadn't been sure about this different 9th object until being prompted by Capt Davidson's drawing of the Rhodes "heel", which was on the evening of July 31 in Seattle. He also said that he'd been so unsure about it he had not mentioned it to a living soul, even his wife, until telling Brown and Davidson on July 31. This would be flatly contradicted by his having sent an explicitly annotated drawing to a magazine publisher two days previously.

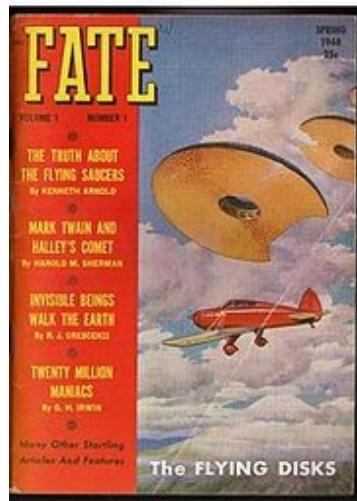
Palmer had offered Arnold 2 cents per word for his article and \$5 for every drawing or photograph that could be used to illustrate it (letter to Arnold, June 26 1947) so when Palmer published that article in FATE did he publish an Arnold drawing showing this crescent? I haven't seen the original magazine but from second-hand descriptions I don't believe he did.

According to Arnold's own account, on July 31 he did not tell Brown & Davidson that he had seen a crescent, but an object he said was "almost identical" to Wm. Rhodes' "heel" or "Flying Flapjack" shape (Rhodes himself compared his object to the Flapjack). This would be anachronistic if he had drawn this very distinctive crescent two days before.

So unless Pierre Lagrange was referring in 1998 to another, similar document that he may have found in Palmer's papers, we have no evidence of a July 29 crescent.

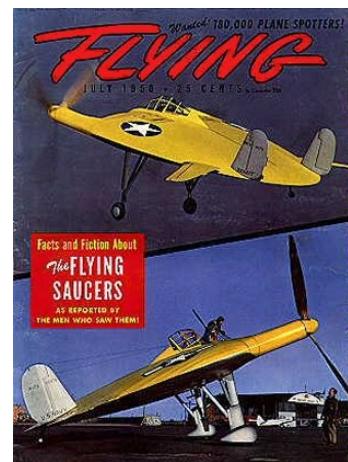
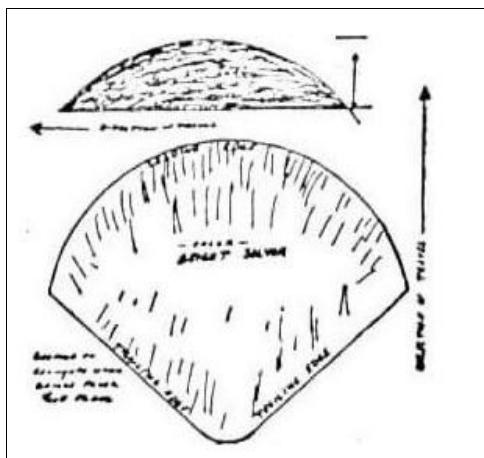
Summary: Consistent with the rest of the record and with Arnold's own later account, Arnold apparently did not, as has been claimed, produce a drawing of a crescent prior to Brown and Davidson's visit with news of the Rhodes photos, or prior to his association with Ray Palmer. The date of the earliest known dateable example is probably on or about August 19 1947.

Aug 1948. Palmer's FATE magazine reprints as *The Truth About the Flying Saucers* Arnold's early account (as sent to the AAF on July 8 1947 and already widely-circulated) describing again only the 9 identical discoids, but with a cover illustration prominently showing a brass-coloured saucer with features of the Rhodes photos - a straight segment cut away from one edge and a hole or blob in the middle.

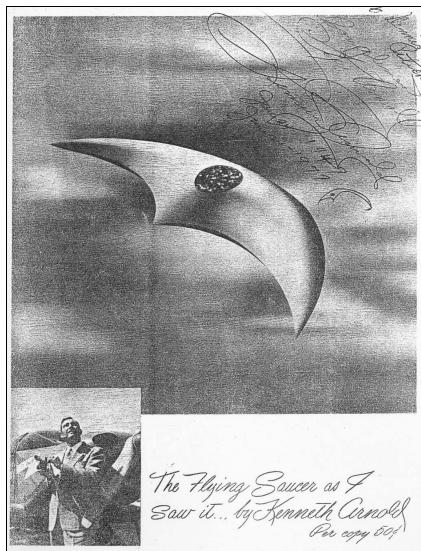


FATE Magazine, Aug 1948

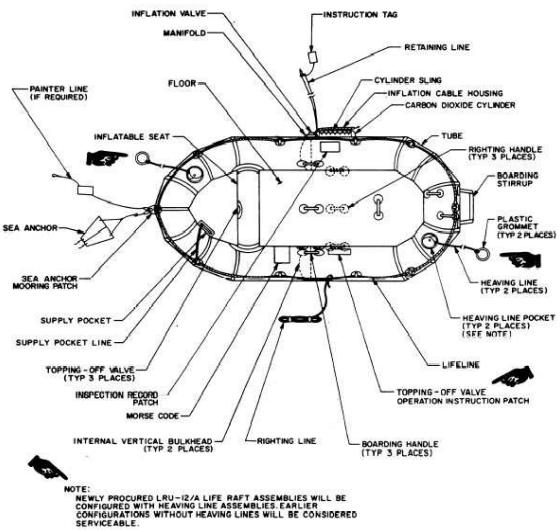
1950 July FLYING magazine publishes "pilots' own drawings" of UFOs sighted including Arnold's (below left), with the Navy XF-5U1 on the cover.



1950. Arnold self-produces a pamphlet (below) showing, above the title *The Flying Saucer As I Saw It* but without any commentary or context, a different shape - a crescent with, as it were, two segments cut away and a mottled blob in the middle. A page 3 photo caption, however, refers to Arnold's sighting of "nine strange raft-like aircraft".



NOTE: Strictly speaking it remains unproven that the crescent image was on the original 1950 version (see below) although it seems probable. The "nine strange raft-like aircraft" presumably refers to the planform of a typical inflatable raft with its rounded stern and more pointed bow (below; compare Arnold's 1947 drawings). Arnold's reference to nine such objects appears to be at odds with the cover's crescent design.



240.129

From Aircrew Survival Equipmentman 1 & C - Aviation theories and other practices

www.tpub.com/.../10330/css/10330_103.htm

1952. Martin Gardner's *Fads and Fallacies in the Name of Science* (Dover, New York, 1957 edition [UFO chapter unrevised] pp 55-68) says that Arnold reported "nine circular objects" and argues that "Arnold's original description tallies remarkably well with . . . balloons" (apparently thinking of a balloon train used for high altitude research since his context is the history of Skyhook).

NOTE: No crescents appear here, but Gardner objects that the saucer craze must have been imagination because of Arnold's claim that he did not specifically use the word "saucer" to describe the shape of these "circular objects", only the skipping motion (not examining the odd implication that Arnold's choice of "skipping saucers" as a simile - rather than "skipping stones", say - must have been totally arbitrary). We don't know if Gardner was the first to make this argument explicitly or was quoting someone else.

Gardner describes in some detail the contents of a pre-1952 copy of Arnold's 1950 pamphlet but does not mention that a crescent-shaped image is shown above the cover title "The Flying Saucer As I Saw It", a fact which, given that this would have been a gift to Gardner's argument, leads to the suspicion that this image may not have been present on the original cover seen by Gardner. I can find no other evidence for this possibility, however.

1952. Palmer & Arnold co-write *The Coming of the Saucers*, containing both the 1948 Rhodes-type image from FATE magazine (on the cover) and the crescent image from the 1950 pamphlet *The Flying Saucer As I Saw It* (in the photo section) again without any explanation, attribution or context. But Arnold's own text nowhere references or even obliquely alludes to the crescent image, and continues to verbally equate one and only one object to the shape in the Rhodes photos, repeating that he saw "discs" like those also seen by Capt E. J. Smith and other saucer sighters. (He also describes here for the first time an aerial encounter on July 29 1947 - two days before he was informed about the Rhodes photos by Brown and Davidson in Tacoma - with ten brass-coloured discs all having a spot in the middle, which may relate to the Aug 1948 FATE cover illustration.)

1954. Harold Wilkins in *Flying Saucers on the Attack* claims that Arnold described a 9th object as "a strange machine like a half-moon with a tail in it! Or looking like a half-peak in the center of the disk", adding what purports to be a quote from Arnold: "The peculiar object drawn by [Lt] Brown had a length one-fourth that of its width, and seemed bat-like in the tips of its wings."

NOTE: According to Arnold himself, the Rhodes shape was drawn for him by Capt Davidson, not by Brown, suggesting that this "quote" may be bogus (another claimed Arnold quote in the same chapter almost certainly is). Wilkins cites no source. The reference to "bat-like wings" seems incongruous in connection with Rhodes. Does it relate to the East Oregonian's June 1947 newspaper quote describing them as "flat like a pie pan and somewhat bat-shaped" (see above)?

1963 Menzel & Boyd write in *The World of Flying Saucers*: "Under the title, 'I Did See the Flying Disks', the article appeared in the first issue of a new magazine, *Fate*, which published 'true stories of the strange, the unusual, the unknown.' Although Arnold was not a professional writer, he had the assistance of an expert and produced a vivid, clearly written story - Palmer had had unusual experience in helping fledgling authors tell their tales. Interesting differences between Arnold's original statements and those in the magazine version demonstrate how much he must have owed to editorial help. Without it, he might not have included certain colorful details that he had apparently overlooked earlier. In his original reports, for example, he said that he had at first supposed the disks to be some type of experimental aircraft; in the magazine version he added that, even at the time, the objects had given him 'an eerie feeling.'" (Menzel, Donald H. & Boyd, Lyle G., *The World of Flying Saucers - A Scientific Examination of a Major Myth of the Space Age*, Doubleday & Company, New York, 1963.p.15)

*NOTE: This is inaccurate in several ways, in particular Arnold's 1948 Fate article was not a new "version" edited by Ray Palmer with "colourful" and "vivid" new details differing from Arnold's original. It was a shortened reprint of his original account written within days of the sighting and sent to the AAF about July 8 1947. And Menzel's quotation about the "eerie feeling" comes neither from the Fate article, nor from its original July 1947 source, but from the 1952 Palmer/Arnold book *The Coming of the Saucers*. More importantly Menzel then goes on:*

"In the intervening months he had also remembered more about their shape. He no longer described them as saucerlike, flat and shiny like piepans. Instead, a drawing based on his revised account shows an object like the crescent moon with a sharp protrusion on the inner,

concave side and a dark, mottled circle marking the center of the top surface. Furthermore, he told the readers of *Fate*, one object had been darker than the others and of a slightly different form - a detail he had forgotten to mention to reporters, to military officials, to his friends, or even to his wife."

NOTE: Again Menzel conflates sources and also misrepresents them. The material about a differing 9th object was not in the 1948 article but comes from the 1952 book. Moreover there is no evidence that the crescent illustration therein is "based on [Arnold's] revised account". Arnold does not actually mention it at all, and his own text - vague as it is - contains nothing that can be interpreted as "revising" his original description from 9 flat shiny pie-pans to 9 crescents. Arnold describes one only of the objects, differing from his original description and resembling the Rhodes "heel" photos.

1965 March 11 Notes apparently by Dr J. E. McDonald of a communication from Arnold, (CUFOS McDonald letters file p.2):

'Saucer' misnomer after Arnold described it as, "flying erratically like a saucer skipping along the water".

"Actually, they are more like a crescent or half-moon with a slight pollywog tail and a pulsating-type thing in the center. I presume this pulsation is their power unit.

"I never have seen a round or circular shape. All appeared to me to be much like a giant rayfish from the ocean. That is what reputable pilots like myself also have reported."

NOTE: the "rayfish" possibly prefigures the "ray-like" description mis-quoted by Arnold from his own 1950 pamphlet (which actually has "raft-like") according to Bob Pratt's 1978 interview transcript (see below)

1975 Oct 17 *Oregon Journal*, Portland. "Flying saucer is even a misnomer, of sorts," said Arnold "Most of these objects are raffe-shaped - they look something like the axes that were used to behead people back in the middle ages" Arnold said he saw UFOs on five occasions after the 1947 report and that his own personal theory is that UFOs are not spacecraft but living organisms "It's the way they move," said Arnold "It's more like something alive than a mechanical craft The Air Force never released the best pictures of these things. They have a spot in the middle that pulsates like a heart"

NOTE: "raffe-shaped" is difficult to interpret. Possible corruption of "raft-shaped" (see 1950) or "rayfish-shaped" (see 1965)?

1977 In *The Hynek UFO Report* J.Allen Hynek claims ambiguously that Arnold reported "nine crescent-shaped dislike objects". No source is given

1977. In the same year Donald Menzel's third book likens Arnold's sighting to Menzel's own observation of a line of "horseshoe" shaped images observed through the windscreen of an aircraft. Menzel was able to identify them after a moment as raindrops on the glass that "looked exactly like planes with swept-back wings" (Menzel, D. with Ernest Taves, *The UFO Enigma*, p.6)

NOTE: Whether Menzel and Hynek were influencing one another or if both were independently influenced by a third source in the same year is not known.

1977 June. At the Chicago International UFO Congress in June 1977 Arnold himself is on record saying the objects were "somehow crescent-shaped" [Brad Sparks - personal communication]. In his talk he also likens them to "tadpoles", which is a little confusing, and blames the media for misunderstanding his "saucer" reference to their motion. "But I couldn't quite positively determine if they were all the same design as this [crescent-shaped] one I particularly noticed or whether they were ... Actually this one was a little larger, it seemed a little darker in color

than the others and its wingspan seemed a little bit lighter." (Transcript of a tape, or part of a tape, of Kenneth Arnold's speech at the First International UFO Congress in Chicago, Illinois, USA, in June 1977, published in the "Proceedings of the first International UFO Congress", compiled and edited by Curtis G. Fuller and the editors of Fate magazine, Mary Margaret Fuller, Jerome Clark, Betty Lou White, Warner books editors, USA.)

NOTE: whereas 25 - 30 years previously he had described eight discoids "observed quite plainly" plus one other possibly-different object of quite uncertain form (recollected, after some reflection and encouragement, first as a heel shape and then as a crescent wing), Arnold now appears to say that, on the contrary, it was the unique crescent-shaped object which had been distinct, whilst the others were relatively indistinct.

1977 July 23. A month later, Saturday, July 23 1977, the Pendleton, Oregon, *East Oregonian* (the paper that first reported Arnold's sighting in 1947) published an article: 'Crescents, Not Saucers' which said: "Arnold said ever since he reported his sighting, in late June, 1947, the news media had implied that Arnold saw circular, saucer-shaped craft. Not so. Arnold said the mysterious craft were shaped like crescents and appeared smooth except for glass-like circles on top." The article remarked that Arnold's wife wore a "crescent-shaped saucer" necklace made in 1948. (courtesy Brad Sparks)

1978 Feb 06 (Bob Pratt interview) Arnold tells Bob Pratt: "The ones I saw were definitely crescent-shaped type things, with a pulsating thing in the middle of them" - and extending comparison to the Vision of Ezekiel : "a wing upon a wing, and the burning coals, the fire in the center, and this is identical to the first observation I had."

1978 Feb 24 (Bob Pratt interview) Arnold is quoted reading from his own 1950 'Flying Saucer As I Saw It' pamphlet the caption under the photo showing searchers at the crashed C-46 site on Mt Rainier. ". . . It was while Arnold was engaged in this air search operation that nine strange ray-like aircraft crossed his pathway at speeds exceeding 1,700 miles an hour [emphasis added; see also 1965, March 11 supra]."

NOTE: This 1978 phrase "ray-like aircraft", which tends to connote an object with somewhat laterally extended, pointed wings, oddly does not appear in the pamphlet. Instead the 1950 photo caption has the phrase "raft-like aircraft" which suggests an object of squarer flat area much more like Arnold's original drawings.

1991. Spencer, J., *The UFO Encyclopedia*, Headline Publishing 1991, pp.31-2: "Although often held to be a description of the shape of the objects Arnold saw, it was in fact intended to be a description of their movement . . . Arnold in fact described the objects as boomerang-shaped."

NOTE: There is no known prior source for the claim that Arnold described even one of the objects as boomerang-shaped.

1992 . Author Ronald Story talks with Pendleton *East Oregonian* journalist Bill Becquette, writer of the original AP wire-story that spread news of the "saucers", who confirms that on June 25 1947 he understood Arnold to use "saucer-like" to describe the objects' shape (Ronald Story, *Mammoth Encyclopedia of Extraterrestrial Encounters*, 2001, p100)

1992 July 12 Interview of journalist/author John Keel by Kenn Thomas. "When Kenneth Arnold reported what he had seen Ray Palmer then changed all of his descriptions . . . so the UFO literature to this day prints a false description of what Arnold saw, and if you go and read Kenneth Arnold's own account of it you'll see he saw lights, and saw them from a great distance, from 50 miles away [laughs], and, er, Ray Palmer turned these into metallic spaceships [laughs] and so it was Ray Palmer who really set the whole thing up."

<http://www.radiomisterioso.com/2009/07/20/john-keel-interviewed-by-kenn-thomas/>

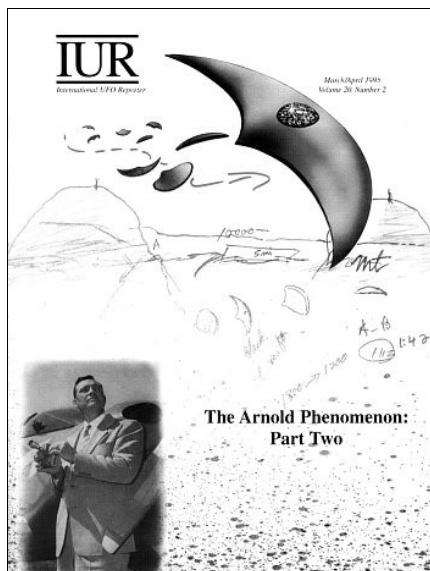
NOTE: A travesty of the facts by an influential writer which demonstrates the extent to which the received wisdom had become corrupted.

1995 Mar/Apr The International UFO Reporter (CUFOS) cover artwork (below) used freehand copies or rough tracings from a sketch on a manilla business envelope in the CUFOS files. The sketch is certainly by Arnold but date and circumstances are uncertain. A History Channel documentary, "UFO Sightings"

<http://www.youtube.com/watch?v=d3oeYAwInXs>

implies that this is a sketch made by Arnold immediately on landing at Yakima on June 24 1947. Brad Sparks (personal communication) contends that it was probably done for a journalist in Arnold's hotel room in Pendleton the next day, on June 25 1947.

NOTE: The claim made in the documentary film appears unreliable: a) The preceding still image which purports to zoom in on this sketch being shown by Arnold on June 24 in Yakima is in fact a well-known photo of Arnold joining Capt E.J. Smith in the lobby of the International News Service Building in Seattle on July 5 to view the Coast Guard photo taken by Frank Ryman; b) Arnold said that on landing at Yakima he went to Al Baxter's office and "drew him pictures of what I had seen". Baxter called in some pilots and instructors and they all joined in debate. Then, when in the air on his way back to Pendleton, "I remembered that I had forgotten to mention the fact that one of these craft looked different..." (Coming of the Saucers, p.13). As already mentioned above, in 1952 Arnold expressed regret and some puzzlement that he hadn't said anything to anyone about a different or crescent-shaped 9th object. But if Arnold had drawn this picture for the press within 2 days of the event then in fact quite a few people would have known about a different-shaped object.



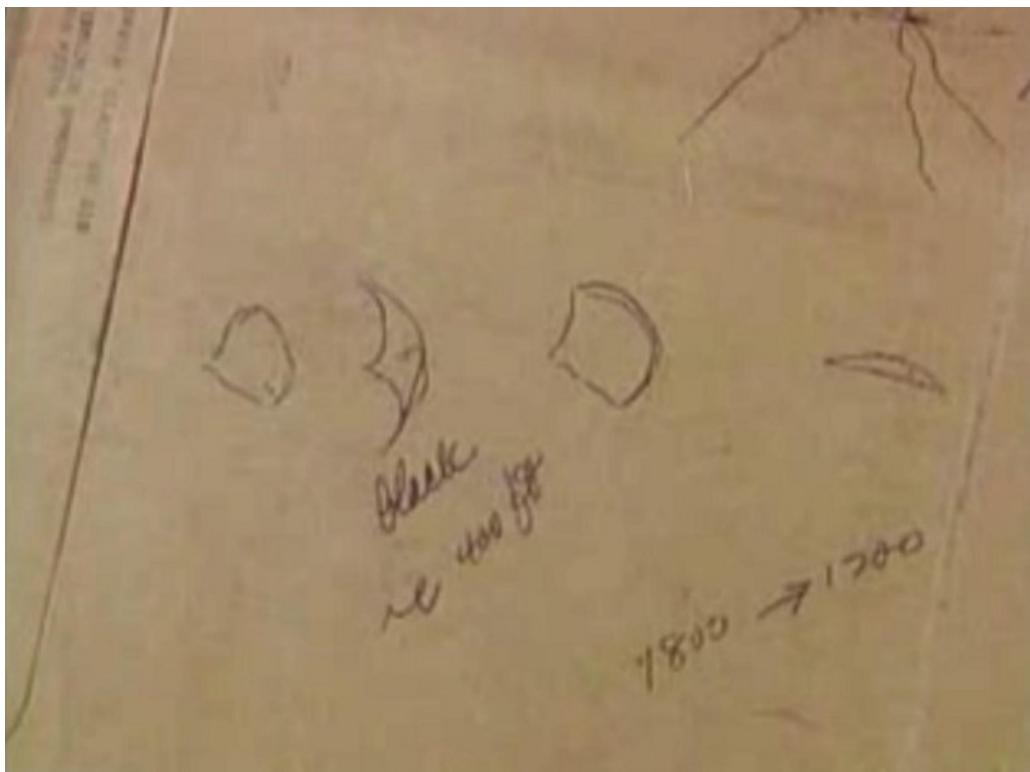
IUR cover Mar/Apr 1995

It remains possible that the sketch was done by Arnold at an early date for private purposes. Inquiries have so far failed to pin down the date or other details of provenance. The envelope is (or was) a new, unmailed business envelope. Mark Rhodegier of CUFOS says that the envelope has been in the CUFOS file since at least the late '70s. He thinks it looks older than that but can't be sure. Mary Castner and Barry Greenwood have looked into the manufacture and marketing of the envelope and when the company on the label "The United States Envelope, Co" of Springfield, Mass, stopped trading under that name etc. The company were taken over by Mead in 1960 but the trade name continued in use and Mary has found the company mentioned by TIME magazine as actively trading in 1970.

<http://www.time.com/time/magazine/article/0,9171,877073,00.html>

The only other clue is the absence of Zip codes on Arnold's address label and the envelope manufacturer's address. Zip codes came in in 1963. That could mean that it is pre-1963. On the other hand, Zip codes were not actually required until quite recently and many mailings would have been done without them through the 60s and 70s. Moreover, neither address carries the earlier 2-digit Zone codes either, so this weakens any possible inference.

The upshot is that it's almost certainly pre-1977ish, possibly pre-1970 although not necessarily, but no one knows of any actual evidence for the claim that it was done in Arnold's hotel room on about June 25 1947. In the absence of any source for this claim the story should be regarded as merely a rumour.



A detail of Arnold's undated manilla envelope sketch showing a crescent form

1995. James Randi's book "An Encyclopaedia of Claims, Frauds and Hoaxes of the Occult and Supernatural" claims:

'Kenneth Arnold. A private pilot who reported that on June 24th, 1947, he had seen nine "crescent-shaped" flying objects while in his private plane near Mt. Rainier, Washington State. He also described them as shaped like "boomerangs," and said that their motion was similar to that of a saucer skipping (or skimming) when thrown flat across the water. The media simplified the motion description into a more attention-grabbing headline: "flying saucers." This started the UFO craze, which has generated millions of words of fantasy fiction and is still very much with us, like the common cold.'

NOTE: This is taken from the web version at

<http://www.randi.org/encyclopedia/Arnold,%20Kenneth.html>

1997. Robert Sheaffer, *The Truth Is, They Never Were 'Saucers'*, Skeptical Inquirer, Vol. 21.5, September/October 1997:

'Arnold didn't say that the objects looked like saucers. Instead, Arnold told a reporter that "they flew erratic, like a saucer if you skip it across the water." Actually, what he said was that they looked like boomerangs, but the reporter's account called them "flying saucers." And since newspapers were soon filled with reports of "flying saucers" in the skies, "flying saucers" are what people reported seeing, not "flying boomerangs." Seldom has the power of suggestion been so convincingly demonstrated.'

2000. Robert E. Bartholomew and Erich Goode, *Mass Delusions and Hysterias: Highlights from the Past Millennium*, Skeptical Inquirer, Vol. 24.3, May/June 2000:

'It is notable that at this point, Arnold had described the objects as crescent-shaped, referring only to their movement as "like a saucer would if you skipped it across the water"'

2003 Robert Todd Carroll, *The Skeptic's Dictionary*, John Wiley & Son, 2003 p.146

On June 24, 1947, Kenneth Arnold claimed that he'd seen nine "crescent shaped" aircraft flying erratically at incredible speeds near Mount Rainier. He said they reminded him of saucers skimming over water. An editor of the Eastern Oregonian reported that Arnold saw "round" objects. Other reports noted "disc-shaped" objects. Within a few weeks there were hundreds of reports nationwide of sightings of "flying saucers"

2008 Apr 02, *UFOs & the Argument from Ignorance*, Neurologica blog, Steven Novella MD:

'Skeptics also point out that the very concept of a "flying saucer" was born of nothing more than a reporter's liberties. In 1947, pilot Kenneth Arnold started the modern flying saucer craze when he reported seeing several UFOs. He described them as boomerang-shaped, but also noted that they were hopping, like a saucer skipping on the water. A reporter then coined the phrase "flying saucer" and the image stuck. And the fact that most UFO witnesses report seeing saucer-shaped objects demonstrates how suggestible we are.'

<http://www.theness.com/neurologicablog/?p=264>

2009. Robert Sheaffer, *UFOlogy 2009: A Six-Decade Perspective*, Skeptical Inquirer Volume 33.1, January / February 2009:

'... others began reporting seeing the "saucers" too (a curious development, since Arnold did not say that the objects looked like saucers—they looked like boomerangs, he said—but skipped like saucers, a subtlety lost in the public's imagination). Soon sightings of "saucers" were pouring in from all around the country and from around the world.'

* * *

Kenneth Arnold died on Jan 16 1984 in Bellevue, Washington