The FLIR, GOFAST, and GIMBAL videos are NOT debunked!😡 Next time ask an actual fighter pilot!✈

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New

1
00:00:06,389 --> 00:00:03,270
hello so uh chris lato a former

2
00:00:07,190 --> 00:00:06,399
f-16 fighter pilot has released a couple

3
00:00:10,709 --> 00:00:07,200
of videos

4
00:00:14,310 --> 00:00:10,719
that he says debunk my debunks he

5
00:00:15,430 --> 00:00:14,320
debunks the gimbal video and the go fast

6
00:00:18,950 --> 00:00:15,440
video

7
00:00:21,029 --> 00:00:18,960
now i disagree with his uh analysis and

8
00:00:23,029 --> 00:00:21,039
i'm going to explain why

9
00:00:25,269 --> 00:00:23,039
let's start with the go fast analysis

10
00:00:27,910 --> 00:00:25,279
now the majority of his

11
00:00:31,029 --> 00:00:27,920
uh criticism of this appears to be based

12
00:00:32,870 --> 00:00:31,039
on focus he spends a lot of time

13
00:00:34,630 --> 00:00:32,880

explaining that he doesn't think that

14
00:00:35,190 --> 00:00:34,640
something can be five miles away in

15
00:00:39,670 --> 00:00:35,200
focus

16
00:00:41,990 --> 00:00:39,680
camera his obvious to anyone who's ever

17
00:00:42,709 --> 00:00:42,000
flown these things is you can't focus at

18
00:00:44,790 --> 00:00:42,719
something

19
00:00:45,750 --> 00:00:44,800
10 miles away and then focus at

20
00:00:48,069 --> 00:00:45,760
something

21
00:00:49,110 --> 00:00:48,079
five miles away it just is not how

22
00:00:51,750 --> 00:00:49,120
physics works right

23
00:00:53,350 --> 00:00:51,760
and he does a bunch of uh demonstrations

24
00:00:55,270 --> 00:00:53,360
along these lines i

25
00:00:56,549 --> 00:00:55,280
i could do i could demonstrate the

26
00:00:58,229 --> 00:00:56,559
effect he's doing

27
00:01:00,950 --> 00:00:58,239
quite easily by holding up something

28
00:01:03,349 --> 00:01:00,960
halfway between the camera and my face

29
00:01:04,789 --> 00:01:03,359
my face is in focus but this thing which

30
00:01:06,550 --> 00:01:04,799
is halfway between them

31
00:01:08,390 --> 00:01:06,560
is not so you could think my face is at

32
00:01:08,950 --> 00:01:08,400
10 miles and this is at five miles and

33
00:01:10,469 --> 00:01:08,960
so

34
00:01:11,990 --> 00:01:10,479
you know you can't be both in focus at

35
00:01:14,870 --> 00:01:12,000
the same time but of course

36
00:01:15,830 --> 00:01:14,880
this this isn't actually true uh in the

37
00:01:17,270 --> 00:01:15,840
in the broad

38
00:01:18,870 --> 00:01:17,280

sense of you know 10 miles and five

39
00:01:20,149 --> 00:01:18,880
miles being in focus at the same time

40
00:01:23,590 --> 00:01:20,159
like here's

41
00:01:24,550 --> 00:01:23,600
a picture of yosemite this shows el

42
00:01:26,469 --> 00:01:24,560
capitan

43
00:01:28,310 --> 00:01:26,479
which is this big one in the front which

44
00:01:29,350 --> 00:01:28,320
is 5 miles away from the camera and it

45
00:01:31,670 --> 00:01:29,360
shows half dome

46
00:01:33,350 --> 00:01:31,680
which is 10 miles away from the camera

47
00:01:34,390 --> 00:01:33,360
and both of them are in perfect focus

48
00:01:36,230 --> 00:01:34,400
and this is at

49
00:01:38,469 --> 00:01:36,240
200 millimeters so it's not a wide angle

50
00:01:40,789 --> 00:01:38,479
lens it's actually a zoom lens

51
00:01:42,789 --> 00:01:40,799
so it's zoomed in it's not zoomed in as

52
00:01:43,270 --> 00:01:42,799
much as the app layer system of course

53
00:01:47,429 --> 00:01:43,280
but

54
00:01:51,990 --> 00:01:47,439
i also have uh a nikon p900

55
00:01:54,950 --> 00:01:52,000
which has a 2000 millimeter equivalent

56
00:01:56,310 --> 00:01:54,960
lens uh which gives it pretty much the

57
00:01:58,630 --> 00:01:56,320
same field of view as

58
00:01:59,350 --> 00:01:58,640
the app layer system and i've modified

59
00:02:01,109 --> 00:01:59,360
it to take

60
00:02:02,950 --> 00:02:01,119
infrared images it's a short wave

61
00:02:04,630 --> 00:02:02,960
infrared not long wave infrared but you

62
00:02:07,190 --> 00:02:04,640
know it's still infrared

63
00:02:08,790 --> 00:02:07,200

and i took it up to the lake and i

64
00:02:10,550 --> 00:02:08,800
focused on the far sure of the lake

65
00:02:12,229 --> 00:02:10,560
which is about four miles away

66
00:02:13,830 --> 00:02:12,239
and then i moved the camera down so i

67
00:02:15,190 --> 00:02:13,840
was looking looking at the near shore of

68
00:02:16,710 --> 00:02:15,200
the lake which was about half a mile

69
00:02:18,470 --> 00:02:16,720
away they were both in focus

70
00:02:20,229 --> 00:02:18,480
even though i was at maximum zoom full

71
00:02:21,030 --> 00:02:20,239
two thousand millimeter one degree field

72
00:02:23,030 --> 00:02:21,040
of view

73
00:02:24,390 --> 00:02:23,040
both things are in focus i did this for

74
00:02:25,270 --> 00:02:24,400
a bunch of other things it's kind of

75
00:02:26,869 --> 00:02:25,280
difficult to do

76
00:02:29,110 --> 00:02:26,879
a ground level because you always get

77
00:02:30,550 --> 00:02:29,120
this this heat haze and shimmering

78
00:02:33,589 --> 00:02:30,560
it's a little easier if you're higher up

79
00:02:35,910 --> 00:02:33,599
but it's the point is it's not

80
00:02:38,150 --> 00:02:35,920
impossible to get things in focus at the

81
00:02:39,990 --> 00:02:38,160
same time at 5 miles and 10 miles

82
00:02:42,390 --> 00:02:40,000
really his experiments in the kitchen do

83
00:02:43,270 --> 00:02:42,400
not scale to larger scale you can't take

84
00:02:45,589 --> 00:02:43,280
something on the

85
00:02:47,030 --> 00:02:45,599
order of feet like we have here where

86
00:02:50,630 --> 00:02:47,040
things are not in focus

87
00:02:52,229 --> 00:02:50,640
and scale that up to miles

88
00:02:55,110 --> 00:02:52,239

quite obviously like you know this

89
00:02:57,589 --> 00:02:55,120
picture here things are in focus

90
00:02:58,710 --> 00:02:57,599
so it goes on from that to say that

91
00:03:01,750 --> 00:02:58,720
because

92
00:03:03,589 --> 00:03:01,760
they can't both be in focus then the

93
00:03:04,869 --> 00:03:03,599
range value that's on screen must be

94
00:03:06,949 --> 00:03:04,879
wrong

95
00:03:08,949 --> 00:03:06,959
and he doesn't really justify why it's

96
00:03:10,070 --> 00:03:08,959
wrong so it's kind of basing this i

97
00:03:12,149 --> 00:03:10,080
think on this focus

98
00:03:13,350 --> 00:03:12,159
issue and then saying it must be wrong

99
00:03:15,990 --> 00:03:13,360
but in it's been

100
00:03:17,990 --> 00:03:16,000
three years now no one else has ever

101
00:03:20,309 --> 00:03:18,000
suggested that this range value

102
00:03:21,509 --> 00:03:20,319
uh is wrong and nobody seriously has

103
00:03:24,149 --> 00:03:21,519
brought it up i think

104
00:03:25,110 --> 00:03:24,159
louis elizondo briefly mentioned it but

105
00:03:26,710 --> 00:03:25,120
uh

106
00:03:28,550 --> 00:03:26,720
everybody like all the other pilots who

107
00:03:29,990 --> 00:03:28,560
have looked at it up to this point

108
00:03:32,390 --> 00:03:30,000
you know they've accepted this as far as

109
00:03:33,910 --> 00:03:32,400
i know so i'm gonna leave that one there

110
00:03:35,509 --> 00:03:33,920
because chris himself has kind of said

111
00:03:37,830 --> 00:03:35,519
you know there's a bit of doubt there

112
00:03:39,589 --> 00:03:37,840
hey this ain't no go fast what about the

113
00:03:40,149 --> 00:03:39,599

depth of field maybe the depth of field

114
00:03:42,710 --> 00:03:40,159
okay

115
00:03:44,390 --> 00:03:42,720
let's try it on this one and uh let's

116
00:03:45,589 --> 00:03:44,400
move on to the more interesting one the

117
00:03:47,750 --> 00:03:45,599
gimbal video

118
00:03:49,110 --> 00:03:47,760
so chris's argument here is that the

119
00:03:51,430 --> 00:03:49,120
object is not far away

120
00:03:52,789 --> 00:03:51,440
i made the argument that it might be a a

121
00:03:53,830 --> 00:03:52,799
jet that's far away i think it's

122
00:03:56,470 --> 00:03:53,840
probably not

123
00:03:57,589 --> 00:03:56,480
uh an airline i think it could be though

124
00:03:59,030 --> 00:03:57,599
it might just be

125
00:04:00,470 --> 00:03:59,040
another f-18 but it could be something

126
00:04:01,670 --> 00:04:00,480
that's really far away and we'll kind of

127
00:04:05,270 --> 00:04:01,680
get into that later

128
00:04:07,750 --> 00:04:05,280
now chris draws this diagram on his uh

129
00:04:10,789 --> 00:04:07,760
his video here

130
00:04:12,390 --> 00:04:10,799
this is an overhead diagram of the

131
00:04:15,670 --> 00:04:12,400
motion of the jet

132
00:04:17,349 --> 00:04:15,680
and uh he was going to draw some lines

133
00:04:19,270 --> 00:04:17,359
of bearing lines of bearing

134
00:04:21,590 --> 00:04:19,280
we show you where the camera is looking

135
00:04:23,749 --> 00:04:21,600
and it's fairly straightforward he

136
00:04:24,950 --> 00:04:23,759
has three points there's two shown here

137
00:04:28,230 --> 00:04:24,960
at the moment there's

138
00:04:30,150 --> 00:04:28,240

point one and uh

139
00:04:32,710 --> 00:04:30,160
at that point it's pointing 53 degrees

140
00:04:36,350 --> 00:04:32,720
left 0.2 is pointing 38 degrees left and

141
00:04:41,749 --> 00:04:40,310
0.3 right here is pointing 21 degrees

142
00:04:44,550 --> 00:04:41,759
left so 53

143
00:04:45,590 --> 00:04:44,560
38 21 and these are just 10 seconds

144
00:04:48,310 --> 00:04:45,600
apart

145
00:04:50,390 --> 00:04:48,320
in the video so we know a bunch of other

146
00:04:53,909 --> 00:04:50,400
things we know how fast the jet is going

147
00:04:56,950 --> 00:04:53,919
uh on screen we have the the speed so

148
00:04:58,909 --> 00:04:56,960
242 here i think we take it 241 is a

149
00:05:00,310 --> 00:04:58,919
good average because it goes from 240 to

150
00:05:03,350 --> 00:05:00,320
242.

151
00:05:04,469 --> 00:05:03,360
so 241 knots now this is the calibrated

152
00:05:06,629 --> 00:05:04,479
airspeed

153
00:05:09,510 --> 00:05:06,639
and this is an important distinction

154
00:05:11,590 --> 00:05:09,520
that you need to understand this

155
00:05:13,029 --> 00:05:11,600
a few types of ways of measuring air

156
00:05:15,270 --> 00:05:13,039
speed which is how fast you're moving

157
00:05:16,469 --> 00:05:15,280
relative to the air around you

158
00:05:19,350 --> 00:05:16,479
the two important ones here are

159
00:05:21,110 --> 00:05:19,360
calibrated air spreed and true air speed

160
00:05:22,469 --> 00:05:21,120
true air speed as the name kind of

161
00:05:24,710 --> 00:05:22,479
suggests is how

162
00:05:25,990 --> 00:05:24,720
actually fast you are moving relative to

163
00:05:27,830 --> 00:05:26,000

the air around you

164
00:05:29,510 --> 00:05:27,840
so if there's like you know a cloud here

165
00:05:31,270 --> 00:05:29,520
in the air and you zip past it

166
00:05:33,990 --> 00:05:31,280
your speed relative to that cloud which

167
00:05:37,350 --> 00:05:34,000
isn't moving is your true air speed

168
00:05:39,350 --> 00:05:37,360
there's also a calibrated air speed

169
00:05:41,270 --> 00:05:39,360
which is related to indicated airspeed

170
00:05:41,670 --> 00:05:41,280
which is how fast your instruments tell

171
00:05:45,590 --> 00:05:41,680
you

172
00:05:48,629 --> 00:05:45,600
use these little pitot

173
00:05:50,790 --> 00:05:48,639
tubes uh which measure the difference in

174
00:05:53,670 --> 00:05:50,800
pressure front and back and they

175
00:05:55,350 --> 00:05:53,680
they they have these little chambers

176
00:05:56,950 --> 00:05:55,360
which figure out uh

177
00:05:58,870 --> 00:05:56,960
how fast you're moving but the indicated

178
00:06:00,629 --> 00:05:58,880
air speed varies with altitude it's not

179
00:06:03,510 --> 00:06:00,639
the same as true airspeed

180
00:06:04,230 --> 00:06:03,520
however it's a a useful number because

181
00:06:07,590 --> 00:06:04,240
it's

182
00:06:08,870 --> 00:06:07,600
speeds are given so you're like your

183
00:06:10,950 --> 00:06:08,880
stall speed and

184
00:06:12,950 --> 00:06:10,960
uh your various other speeds that you

185
00:06:14,390 --> 00:06:12,960
need and your various other maneuvering

186
00:06:17,510 --> 00:06:14,400
things they're all given in this

187
00:06:19,430 --> 00:06:17,520
uh this indicated airspeed or rather

188
00:06:20,870 --> 00:06:19,440

calibrated airspeed which is indicated

189
00:06:24,550 --> 00:06:20,880
as speed corrected

190
00:06:27,270 --> 00:06:24,560
for the uh uh instrument errors

191
00:06:29,670 --> 00:06:27,280
so we've got two sps calibrated aspirin

192
00:06:30,309 --> 00:06:29,680
which is his number here 241 we're going

193
00:06:33,029 --> 00:06:30,319
with

194
00:06:34,309 --> 00:06:33,039
and we have true airspeed you can

195
00:06:36,950 --> 00:06:34,319
convert between the two

196
00:06:38,390 --> 00:06:36,960
and the way you do that is you take the

197
00:06:39,189 --> 00:06:38,400
altitude into account because the

198
00:06:41,270 --> 00:06:39,199
altitude

199
00:06:42,550 --> 00:06:41,280
tells you what the pressure is based on

200
00:06:43,350 --> 00:06:42,560
a standard atmosphere we're just

201
00:06:46,550 --> 00:06:43,360
assuming

202
00:06:47,830 --> 00:06:46,560
standard atmosphere here you take the

203
00:06:49,749 --> 00:06:47,840
calibrated calibrated airspeed and you

204
00:06:51,029 --> 00:06:49,759
take the altitude just plug it into one

205
00:06:53,749 --> 00:06:51,039
of these calculators

206
00:06:54,950 --> 00:06:53,759
and it comes out as being 350 knots you

207
00:06:58,189 --> 00:06:54,960
can do that here

208
00:07:01,270 --> 00:06:58,199
is 25 000 feet calibrated sp

209
00:07:04,550 --> 00:07:01,280
241 41 comes up

210
00:07:05,189 --> 00:07:04,560
true sp 350 knots so that's the number

211
00:07:07,749 --> 00:07:05,199
we're gonna

212
00:07:10,790 --> 00:07:07,759
we need if we want to know how actual

213
00:07:12,710 --> 00:07:10,800

the actual distance is moving in the air

214
00:07:15,189 --> 00:07:12,720
as opposed to calibrated airspeed which

215
00:07:18,150 --> 00:07:15,199
is an aerodynamic concept really

216
00:07:19,589 --> 00:07:18,160
not the actual movement so going back to

217
00:07:22,150 --> 00:07:19,599
chris's video

218
00:07:23,990 --> 00:07:22,160
uh he does some kind of rule of thumb

219
00:07:26,629 --> 00:07:24,000
based on his experience and knowledge

220
00:07:27,510 --> 00:07:26,639
and says that there's a certain turn

221
00:07:30,629 --> 00:07:27,520
radius

222
00:07:32,309 --> 00:07:30,639
standard rate of turn which is

223
00:07:33,670 --> 00:07:32,319
two minutes turn takes two minutes to go

224
00:07:35,670 --> 00:07:33,680
around a full 360

225
00:07:37,029 --> 00:07:35,680
which means you go three degrees every

226
00:07:39,350 --> 00:07:37,039
second so there's a standard rate of

227
00:07:43,189 --> 00:07:39,360
turn three degrees per second

228
00:07:46,390 --> 00:07:43,199
and he kind of kind of knows what the

229
00:07:49,430 --> 00:07:46,400
radius would be i think he puts it at 4

230
00:07:51,510 --> 00:07:49,440
2.4 2.4 nautical miles radius so from

231
00:07:52,550 --> 00:07:51,520
here the center of this turn to here 2.4

232
00:07:54,309 --> 00:07:52,560
nautical miles

233
00:07:56,309 --> 00:07:54,319
he's got his scale here one nautical

234
00:07:57,670 --> 00:07:56,319
mile and we're going to know how

235
00:07:59,589 --> 00:07:57,680
fast we're moving and how far we're

236
00:08:00,390 --> 00:07:59,599
going so he i'm not sure how he did this

237
00:08:02,550 --> 00:08:00,400
exactly but

238
00:08:04,070 --> 00:08:02,560

i guess it's a circle going around here

239
00:08:05,350 --> 00:08:04,080
it doesn't look like quite a perfect

240
00:08:07,909 --> 00:08:05,360
circle but it's probably

241
00:08:09,430 --> 00:08:07,919
close enough really so he starts here

242
00:08:12,309 --> 00:08:09,440
planes pointing upwards

243
00:08:14,469 --> 00:08:12,319
uh it goes to here the plane is now

244
00:08:17,189 --> 00:08:14,479
around a bit to the right and over here

245
00:08:19,909 --> 00:08:17,199
and he draws the line relative to the

246
00:08:21,670 --> 00:08:19,919
heading of the plane

247
00:08:23,830 --> 00:08:21,680
for the camera for each position so here

248
00:08:26,710 --> 00:08:23,840
53 degrees

249
00:08:27,909 --> 00:08:26,720
from straight ahead and the next one 38

250
00:08:30,070 --> 00:08:27,919
degrees from straight ahead

251
00:08:31,589 --> 00:08:30,080
and then the last one 21 degrees from

252
00:08:33,110 --> 00:08:31,599
straight ahead

253
00:08:35,110 --> 00:08:33,120
and then he shows where the intersect

254
00:08:36,310 --> 00:08:35,120
and it's pretty close saying like three

255
00:08:38,469 --> 00:08:36,320
miles away so

256
00:08:39,430 --> 00:08:38,479
that doesn't seem to really line up with

257
00:08:43,110 --> 00:08:39,440
the hypothesis

258
00:08:47,030 --> 00:08:43,120
of a distant jet does it

259
00:08:50,150 --> 00:08:47,040
so what i did is i tried to

260
00:08:52,870 --> 00:08:50,160
try to replicate this and what

261
00:08:53,670 --> 00:08:52,880
the way i did it was i used geogebra

262
00:08:55,269 --> 00:08:53,680
which is this

263
00:08:57,190 --> 00:08:55,279

nice little geometry program you can

264
00:08:59,430 --> 00:08:57,200
just stick in all kinds of numbers and

265
00:08:59,829 --> 00:08:59,440
equations and do lines and intersections

266
00:09:01,269 --> 00:08:59,839
and

267
00:09:03,990 --> 00:09:01,279
you know basically i'm trying to do the

268
00:09:05,910 --> 00:09:04,000
exact same thing he was doing so

269
00:09:07,829 --> 00:09:05,920
we've got right here this is where the

270
00:09:09,269 --> 00:09:07,839
jet is starting so this point one is the

271
00:09:11,190 --> 00:09:09,279
same as his point one

272
00:09:13,110 --> 00:09:11,200
point two here is the same as his point

273
00:09:15,110 --> 00:09:13,120
two and point three

274
00:09:17,430 --> 00:09:15,120
it's also the same as his point three

275
00:09:17,990 --> 00:09:17,440
and so you can see here we have 53

276
00:09:24,630 --> 00:09:18,000
degrees

277
00:09:27,910 --> 00:09:24,640
circle around which the plane goes

278
00:09:28,550 --> 00:09:27,920
and here i have the true airspeed at 350

279
00:09:31,350 --> 00:09:28,560
knots

280
00:09:33,590 --> 00:09:31,360
and i have the rate of turn set to three

281
00:09:35,670 --> 00:09:33,600
degrees per second now i'll explain

282
00:09:37,190 --> 00:09:35,680
at the end of the video what all these

283
00:09:39,350 --> 00:09:37,200
calculations are if you're interested in

284
00:09:42,470 --> 00:09:39,360
the math but basically this is just

285
00:09:43,350 --> 00:09:42,480
essentially the same thing as as chris

286
00:09:47,269 --> 00:09:43,360
had

287
00:09:49,750 --> 00:09:47,279
but in a more easily replicable form

288
00:09:51,590 --> 00:09:49,760

so i could do things like i could i

289
00:09:52,870 --> 00:09:51,600
could say if the true sv was actually

290
00:09:54,070 --> 00:09:52,880
450 like

291
00:09:55,910 --> 00:09:54,080
what difference would it make you know

292
00:09:59,590 --> 00:09:55,920
not a lot of difference actually so

293
00:10:02,870 --> 00:09:59,600
let's go back to 350 which is the actual

294
00:10:05,910 --> 00:10:02,880
airspeed so this is all based

295
00:10:09,509 --> 00:10:05,920
a upon a standard rate of turn

296
00:10:11,430 --> 00:10:09,519
of three degrees per second

297
00:10:13,590 --> 00:10:11,440
so the plane is turning to the left

298
00:10:17,110 --> 00:10:13,600
three degrees every second

299
00:10:21,509 --> 00:10:17,120
and it's traveling along this circle at

300
00:10:23,269 --> 00:10:21,519
um 350 knots true airspeed

301
00:10:26,790 --> 00:10:23,279
what happens though if we had a smaller

302
00:10:30,069 --> 00:10:26,800
rate of turn or if we go down to say

303
00:10:33,030 --> 00:10:30,079
2.5 now you can see here already the

304
00:10:33,350 --> 00:10:33,040
uh makes the circle a bit bigger because

305
00:10:36,389 --> 00:10:33,360
we're

306
00:10:38,710 --> 00:10:36,399
not turning so much and the

307
00:10:40,389 --> 00:10:38,720
lines the lines of bearing of the camera

308
00:10:42,389 --> 00:10:40,399
kind of go out a little bit further and

309
00:10:44,550 --> 00:10:42,399
the intersection is a little bit further

310
00:10:46,230 --> 00:10:44,560
now if you go out even further things

311
00:10:48,550 --> 00:10:46,240
can very quickly take a fairly

312
00:10:50,550 --> 00:10:48,560
dramatic turn we go down to two seeing

313
00:10:52,949 --> 00:10:50,560

things are very far away now

314
00:10:54,710 --> 00:10:52,959
now here i've i've listed the

315
00:10:56,550 --> 00:10:54,720
intersections of these lines so this is

316
00:10:57,990 --> 00:10:56,560
the first line of bearing the second

317
00:10:58,790 --> 00:10:58,000
line of bearing and the third line of

318
00:11:00,550 --> 00:10:58,800
bearing

319
00:11:02,630 --> 00:11:00,560
so this is the intersections of one with

320
00:11:04,069 --> 00:11:02,640
two one with three and two with three so

321
00:11:05,430 --> 00:11:04,079
it's just kind of showing roughly where

322
00:11:06,790 --> 00:11:05,440
they all intersect

323
00:11:08,630 --> 00:11:06,800
probably the interesting one is this

324
00:11:11,910 --> 00:11:08,640
this first one here intersect one

325
00:11:15,030 --> 00:11:11,920
two so this is the first ten seconds

326
00:11:17,350 --> 00:11:15,040
and uh i have it

327
00:11:18,230 --> 00:11:17,360
called out here the distance from here

328
00:11:20,389 --> 00:11:18,240
to here

329
00:11:21,670 --> 00:11:20,399
5.36 nautical miles with a rate of turn

330
00:11:23,670 --> 00:11:21,680
of 2.25

331
00:11:24,870 --> 00:11:23,680
we go back to three which is what uh

332
00:11:26,150 --> 00:11:24,880
chris was using

333
00:11:28,470 --> 00:11:26,160
and it's only three miles away three

334
00:11:29,030 --> 00:11:28,480
nautical miles which obviously is a bit

335
00:11:30,790 --> 00:11:29,040
close

336
00:11:32,550 --> 00:11:30,800
but anyway what if it was even lower

337
00:11:34,710 --> 00:11:32,560
what if it was all the way down to

338
00:11:36,389 --> 00:11:34,720

two you know now we're going up to eight

339
00:11:37,750 --> 00:11:36,399
nautical miles which is kind of

340
00:11:39,110 --> 00:11:37,760
getting more like it but it could be

341
00:11:41,030 --> 00:11:39,120
even lower than that like what about

342
00:11:44,069 --> 00:11:41,040
like you know 1.8

343
00:11:45,350 --> 00:11:44,079
uh 12 nautical miles or if it was like

344
00:11:46,949 --> 00:11:45,360
1.5 or

345
00:11:49,670 --> 00:11:46,959
32 nautical miles it's just all of a

346
00:11:51,829 --> 00:11:49,680
sudden gone really far away

347
00:11:54,069 --> 00:11:51,839
and if we keep going down it quickly

348
00:11:57,190 --> 00:11:54,079
pops into infinity

349
00:11:59,110 --> 00:11:57,200
so the idea that it's close depends very

350
00:12:01,190 --> 00:11:59,120
much on the rate of turn

351
00:12:03,269 --> 00:12:01,200
now chris said it's a standard rate of

352
00:12:06,389 --> 00:12:03,279
turn uh three degrees

353
00:12:06,870 --> 00:12:06,399
per uh second but is it though we can

354
00:12:11,110 --> 00:12:06,880
look at

355
00:12:12,870 --> 00:12:11,120
angle of the bank

356
00:12:14,230 --> 00:12:12,880
so we know the bank angle and we know

357
00:12:16,629 --> 00:12:14,240
the speed

358
00:12:18,069 --> 00:12:16,639
and we know uh we know the altitude but

359
00:12:19,030 --> 00:12:18,079
turns out that's not that's important

360
00:12:21,509 --> 00:12:19,040
because

361
00:12:22,790 --> 00:12:21,519
rate of turn is just based on true

362
00:12:24,870 --> 00:12:22,800
airspeed

363
00:12:27,430 --> 00:12:24,880

at least that's uh how i understand it i

364
00:12:31,750 --> 00:12:27,440
found this this chart

365
00:12:35,269 --> 00:12:31,760
which shows an fa18 as turn capabilities

366
00:12:37,829 --> 00:12:35,279
and down here we have the

367
00:12:38,629 --> 00:12:37,839
rate of turn calculator here over here

368
00:12:41,269 --> 00:12:38,639
we have true

369
00:12:42,150 --> 00:12:41,279
airspeed and down here we have the rate

370
00:12:44,629 --> 00:12:42,160
of turn

371
00:12:46,310 --> 00:12:44,639
so to figure out oh we have bank angles

372
00:12:48,389 --> 00:12:46,320
with different lines here

373
00:12:50,389 --> 00:12:48,399
so if we've got a bank angle of 30

374
00:12:52,389 --> 00:12:50,399
degrees what we do is we take the true

375
00:12:55,750 --> 00:12:52,399
air speed over here which was

376
00:12:56,150 --> 00:12:55,760
350 so just under this 360 line we go

377
00:12:58,550 --> 00:12:56,160
across

378
00:12:59,430 --> 00:12:58,560
until we intersect 30 degrees and then

379
00:13:02,150 --> 00:12:59,440
we go

380
00:13:04,310 --> 00:13:02,160
down and that brings us somewhere around

381
00:13:06,230 --> 00:13:04,320
i guess 1.75

382
00:13:07,670 --> 00:13:06,240
yeah something like that maybe a little

383
00:13:10,069 --> 00:13:07,680
uh one point seven it's a

384
00:13:11,670 --> 00:13:10,079
kind of logarithmic scale here what we

385
00:13:16,870 --> 00:13:11,680
can do is we can plug that

386
00:13:20,150 --> 00:13:16,880
into the equation here 1.7

387
00:13:21,670 --> 00:13:20,160
and it gives us 16 nautical miles away

388
00:13:23,430 --> 00:13:21,680

the very first intersect for the first

389
00:13:25,190 --> 00:13:23,440
10 seconds and actually over the first

390
00:13:26,069 --> 00:13:25,200
10 seconds it's not 30 degrees it's

391
00:13:29,110 --> 00:13:26,079
actually

392
00:13:31,030 --> 00:13:29,120
26 degrees if you measure the angle 26

393
00:13:32,629 --> 00:13:31,040
degrees so if it's 26 degrees that would

394
00:13:36,150 --> 00:13:32,639
be a line somewhere over here

395
00:13:39,829 --> 00:13:36,160
we can imagine this 350 coming across

396
00:13:42,310 --> 00:13:39,839
meeting the uh 26 degree line

397
00:13:44,310 --> 00:13:42,320
over here and then coming down it's even

398
00:13:45,910 --> 00:13:44,320
closer to 1.5 so it could be something

399
00:13:49,509 --> 00:13:45,920
like 1.6

400
00:13:52,949 --> 00:13:49,519
so let's go down to 1.6 and

401
00:13:55,110 --> 00:13:52,959
no it's uh 30 nautical miles away

402
00:13:56,710 --> 00:13:55,120
could possibly even be slightly over you

403
00:13:58,790 --> 00:13:56,720
know right now we're getting into the

404
00:14:00,629 --> 00:13:58,800
kind of asymptotic range where things

405
00:14:02,790 --> 00:14:00,639
diverge very very quickly so if it was a

406
00:14:03,829 --> 00:14:02,800
little bit slower there's 100 nautical

407
00:14:05,350 --> 00:14:03,839
miles

408
00:14:06,629 --> 00:14:05,360
and if we look at the the other

409
00:14:08,310 --> 00:14:06,639
intersection it's not even intersecting

410
00:14:10,470 --> 00:14:08,320
now because it's so far away

411
00:14:13,910 --> 00:14:10,480
we can go up down a little bit and poof

412
00:14:17,189 --> 00:14:13,920
cops who jumps to infinity

413
00:14:18,550 --> 00:14:17,199

so uh the question here you know i i

414
00:14:20,470 --> 00:14:18,560
don't know the exact answer because you

415
00:14:24,230 --> 00:14:20,480
know i could be making some mistake here

416
00:14:27,110 --> 00:14:24,240
that i could be misusing this uh i also

417
00:14:27,990 --> 00:14:27,120
use online calculators to do the same

418
00:14:31,430 --> 00:14:28,000
thing we can

419
00:14:33,110 --> 00:14:31,440
we can take the uh let's see

420
00:14:36,069 --> 00:14:33,120
we can use this as an online calculator

421
00:14:39,470 --> 00:14:36,079
to take 350 degrees take a bank angle of

422
00:14:40,710 --> 00:14:39,480
26 to calculate what we do it's like

423
00:14:44,069 --> 00:14:40,720
1.52

424
00:14:45,110 --> 00:14:44,079
degrees per second which if you stick

425
00:14:47,990 --> 00:14:45,120
that in

426
00:14:49,350 --> 00:14:48,000
to the the equations here 1.52 degrees

427
00:14:51,910 --> 00:14:49,360
per second

428
00:14:56,829 --> 00:14:51,920
and i can actually edit it directly i

429
00:15:02,310 --> 00:14:58,790
1.52

430
00:15:05,670 --> 00:15:02,320
72 nautical miles first intersection

431
00:15:09,350 --> 00:15:07,590
so i think there's some real questions

432
00:15:12,550 --> 00:15:09,360
here about chris's analysis

433
00:15:14,230 --> 00:15:12,560
is it actually close and perhaps we

434
00:15:15,590 --> 00:15:14,240
could resolve these questions what is

435
00:15:19,509 --> 00:15:15,600
the actual

436
00:15:23,030 --> 00:15:19,519
rate of turn of an f-18 in level flight

437
00:15:26,870 --> 00:15:23,040
at 25 000 feet with a 26

438
00:15:30,230 --> 00:15:26,880

28 or 30 degree bank to the left

439
00:15:31,110 --> 00:15:30,240
uh what will be the actual diameter of

440
00:15:33,269 --> 00:15:31,120
this circle

441
00:15:34,550 --> 00:15:33,279
and how far along it will we actually

442
00:15:37,509 --> 00:15:34,560
move given our

443
00:15:39,590 --> 00:15:37,519
true airspeed and what will these what

444
00:15:41,030 --> 00:15:39,600
will these lines point at will they

445
00:15:42,470 --> 00:15:41,040
point at something that's close or

446
00:15:45,749 --> 00:15:42,480
something that's far away

447
00:15:46,870 --> 00:15:45,759
based on my calculations just now using

448
00:15:47,910 --> 00:15:46,880
this chart

449
00:15:50,389 --> 00:15:47,920
it seems like they're pointing at

450
00:15:52,310 --> 00:15:50,399
something that's far away so let's try

451
00:15:54,470 --> 00:15:52,320
to resolve that

452
00:15:55,350 --> 00:15:54,480
and i'd be happy to talk to chris or

453
00:15:57,990 --> 00:15:55,360
anybody else

454
00:15:59,189 --> 00:15:58,000
regarding this but uh if i reached out

455
00:16:00,790 --> 00:15:59,199
on youtube and

456
00:16:02,150 --> 00:16:00,800
perhaps he didn't see my comments but so

457
00:16:03,430 --> 00:16:02,160
i haven't heard anything from him yet

458
00:16:08,150 --> 00:16:03,440
but i'd be happy to

459
00:16:10,790 --> 00:16:08,160
talk about it and go over it

460
00:16:12,230 --> 00:16:10,800
so i think yeah the rest of his gimbal

461
00:16:13,829 --> 00:16:12,240
debunking thing is mostly about he

462
00:16:15,749 --> 00:16:13,839
thinks the glare doesn't look

463
00:16:17,590 --> 00:16:15,759

like what he would expect a glare to

464
00:16:19,749 --> 00:16:17,600
look like but

465
00:16:21,430 --> 00:16:19,759
we've seen glares from planes and they

466
00:16:22,230 --> 00:16:21,440
do have these sharp outlines there's

467
00:16:24,870 --> 00:16:22,240
some by

468
00:16:26,150 --> 00:16:24,880
dave falch where he shows a glare that

469
00:16:28,470 --> 00:16:26,160
looks kind of similar

470
00:16:30,069 --> 00:16:28,480
and i've done experiments myself with a

471
00:16:32,069 --> 00:16:30,079
little thermal camera and

472
00:16:33,910 --> 00:16:32,079
you get this fairly sharp outline it

473
00:16:34,310 --> 00:16:33,920
must be i guess something to do with the

474
00:16:36,310 --> 00:16:34,320
way

475
00:16:37,509 --> 00:16:36,320
thermal images work you get a stark

476
00:16:40,790 --> 00:16:37,519
contrast

477
00:16:43,110 --> 00:16:40,800
and this kind of blob shape anyway so my

478
00:16:46,310 --> 00:16:43,120
point here is this is

479
00:16:48,710 --> 00:16:46,320
just simple facts and it's simple

480
00:16:50,310 --> 00:16:48,720
science and knowledge and mathematics

481
00:16:52,150 --> 00:16:50,320
that we should be able to come to some

482
00:16:53,910 --> 00:16:52,160
agreement on it doesn't have to be like

483
00:16:54,790 --> 00:16:53,920
you know i'm an expert or i'm not an

484
00:16:56,310 --> 00:16:54,800
expert

485
00:16:57,910 --> 00:16:56,320
and you have to trust me or trust

486
00:16:59,430 --> 00:16:57,920
someone else

487
00:17:01,990 --> 00:16:59,440
there should be a very straightforward

488
00:17:02,829 --> 00:17:02,000

answer to what is the rate of turn of

489
00:17:07,510 --> 00:17:02,839
this

490
00:17:09,590 --> 00:17:07,520
so let's figure that out i mean i'm

491
00:17:13,510 --> 00:17:09,600
thinking that it's you know more like

492
00:17:15,829 --> 00:17:13,520
1.6 degrees per second based on this uh

493
00:17:17,350 --> 00:17:15,839
this diagram here that perhaps i am

494
00:17:21,510 --> 00:17:17,360
misunderstanding it

495
00:17:24,870 --> 00:17:23,909
okay so if you're still with me i am

496
00:17:26,230 --> 00:17:24,880
going to

497
00:17:28,789 --> 00:17:26,240
kind of go through this just kind of

498
00:17:31,990 --> 00:17:28,799
explain what's actually going on

499
00:17:34,470 --> 00:17:32,000
uh just the the the broad mathematics of

500
00:17:35,750 --> 00:17:34,480
it so the first number i put into

501
00:17:38,390 --> 00:17:35,760
geogebra

502
00:17:40,230 --> 00:17:38,400
was this rate of turn and yeah i stuck

503
00:17:43,190 --> 00:17:40,240
it at three originally so let me just

504
00:17:45,190 --> 00:17:43,200
edit it back to three

505
00:17:46,789 --> 00:17:45,200
so that's degrees per second three

506
00:17:49,669 --> 00:17:46,799
degrees per second

507
00:17:51,669 --> 00:17:49,679
this turn 10 is how much it turns in 10

508
00:17:54,150 --> 00:17:51,679
degrees which is 30 degrees and you see

509
00:17:57,110 --> 00:17:54,160
that down here

510
00:17:58,470 --> 00:17:57,120
in 10 seconds between 0.1 and 0.2 it has

511
00:17:59,590 --> 00:17:58,480
moved 30 degrees and then it moves

512
00:18:02,630 --> 00:17:59,600
another 30 degrees to

513
00:18:06,070 --> 00:18:02,640

0.3 uh

514
00:18:10,230 --> 00:18:06,080
the turn 360 duration

515
00:18:10,870 --> 00:18:10,240
is the number of seconds it takes to go

516
00:18:14,230 --> 00:18:10,880
around

517
00:18:17,590 --> 00:18:14,240
the circle uh is

518
00:18:17,990 --> 00:18:17,600
is 120 for a two minute standard rate

519
00:18:20,710 --> 00:18:18,000
turn

520
00:18:21,750 --> 00:18:20,720
three degrees per second gives you 120.

521
00:18:24,870 --> 00:18:21,760
and this number here

522
00:18:27,590 --> 00:18:24,880
uh turn circ is turn circumference this

523
00:18:30,070 --> 00:18:27,600
is the circumference of this circle

524
00:18:31,430 --> 00:18:30,080
so this is the calculation here that uh

525
00:18:33,669 --> 00:18:31,440
everything depends on so you want to

526
00:18:36,230 --> 00:18:33,679
make sure you got this right so this is

527
00:18:37,110 --> 00:18:36,240
if we take the true air speed divide it

528
00:18:39,830 --> 00:18:37,120
by

529
00:18:41,190 --> 00:18:39,840
uh 3600 which is the number of seconds

530
00:18:43,830 --> 00:18:41,200
in an hour

531
00:18:46,230 --> 00:18:43,840
that converts not nautical miles per

532
00:18:49,029 --> 00:18:46,240
hour into nautical miles per second

533
00:18:49,830 --> 00:18:49,039
and then we multiply that by 120 120

534
00:18:52,789 --> 00:18:49,840
seconds

535
00:18:54,950 --> 00:18:52,799
to get the length in nautical miles of

536
00:18:55,430 --> 00:18:54,960
the circumference of this circle so it

537
00:18:58,710 --> 00:18:55,440
gives you

538
00:19:00,710 --> 00:18:58,720

11.67 about 12 nautical miles

539
00:19:03,029 --> 00:19:00,720
around you can then take the

540
00:19:05,110 --> 00:19:03,039
circumference and turn it into a radius

541
00:19:07,190 --> 00:19:05,120
by taking the turn circumference and

542
00:19:09,190 --> 00:19:07,200
divided by 2 pi

543
00:19:10,549 --> 00:19:09,200
because circumference is 2 times pi

544
00:19:11,990 --> 00:19:10,559
times the radius

545
00:19:14,950 --> 00:19:12,000
so that gives you a radius which is the

546
00:19:17,990 --> 00:19:14,960
distance from the center to the jet

547
00:19:20,310 --> 00:19:18,000
of 1.86

548
00:19:21,669 --> 00:19:20,320
and then we use that to construct all

549
00:19:23,430 --> 00:19:21,679
these other things so we construct a

550
00:19:26,310 --> 00:19:23,440
circle here this

551
00:19:27,110 --> 00:19:26,320
see this c here is a circle centered on

552
00:19:31,990 --> 00:19:27,120
point c

553
00:19:35,110 --> 00:19:32,000
with a turn radius uh of turn radius

554
00:19:36,549 --> 00:19:35,120
and then we can take the intersection of

555
00:19:38,710 --> 00:19:36,559
the 30 degree line

556
00:19:40,710 --> 00:19:38,720
with that circle and it gives you 0.2

557
00:19:41,830 --> 00:19:40,720
and the intersection of the 60 degree

558
00:19:44,789 --> 00:19:41,840
line with this circle

559
00:19:45,510 --> 00:19:44,799
gives you 0.3 so we can take each of

560
00:19:48,710 --> 00:19:45,520
these points

561
00:19:49,669 --> 00:19:48,720
and now we have the angle of the camera

562
00:19:52,070 --> 00:19:49,679
to the left

563
00:19:53,830 --> 00:19:52,080

and it's 53 degrees here so we take the

564
00:19:54,549 --> 00:19:53,840
the heading here at this point on the

565
00:19:56,470 --> 00:19:54,559
circle

566
00:19:58,789 --> 00:19:56,480
go 53 degrees to the left this gives you

567
00:20:01,430 --> 00:19:58,799
a line of bearing going over there

568
00:20:02,549 --> 00:20:01,440
take this one here we take 38 degrees to

569
00:20:04,470 --> 00:20:02,559
the left of the tangent

570
00:20:06,230 --> 00:20:04,480
of the circle gives you this line of

571
00:20:09,430 --> 00:20:06,240
bearing and this point here

572
00:20:11,190 --> 00:20:09,440
finally 21 degrees to the left of the

573
00:20:12,710 --> 00:20:11,200
tangent to the circle

574
00:20:14,390 --> 00:20:12,720
and it gives you this line of bearing so

575
00:20:17,190 --> 00:20:14,400
we've got the three lines of bearing

576
00:20:18,470 --> 00:20:17,200
which are all you know the same as as in

577
00:20:21,909 --> 00:20:18,480
chris's

578
00:20:23,430 --> 00:20:21,919
uh diagram earlier and uh then

579
00:20:24,950 --> 00:20:23,440
i'm simply taking the intersection

580
00:20:28,230 --> 00:20:24,960
between the lines here

581
00:20:29,590 --> 00:20:28,240
so given that this is all computed from

582
00:20:31,510 --> 00:20:29,600
the rate of turn

583
00:20:33,830 --> 00:20:31,520
and the true airspeed the only two two

584
00:20:36,070 --> 00:20:33,840
variables we have here

585
00:20:37,830 --> 00:20:36,080
other than 10 second intervals we can

586
00:20:39,430 --> 00:20:37,840
then take the rate of turn and we can we

587
00:20:41,110 --> 00:20:39,440
can adjust it and see what effect it has

588
00:20:42,630 --> 00:20:41,120

now obviously if we go down to

589
00:20:45,270 --> 00:20:42,640
a zero rated term we're going in a

590
00:20:47,750 --> 00:20:45,280
straight line and the the

591
00:20:49,190 --> 00:20:47,760
the circle flattens out but you know

592
00:20:50,630 --> 00:20:49,200
we're interested in

593
00:20:52,230 --> 00:20:50,640
standard rate of turn looks like this

594
00:20:54,950 --> 00:20:52,240
looks like chris's diagram

595
00:20:55,510 --> 00:20:54,960
rate of turn that's lower like 1.8 or

596
00:20:57,750 --> 00:20:55,520
whatever

597
00:21:00,470 --> 00:20:57,760
things get to be much much further away

598
00:21:03,590 --> 00:21:00,480
uh say 12 nautical miles there for 1.8

599
00:21:06,789 --> 00:21:03,600
or 42 multiple miles for

600
00:21:09,590 --> 00:21:06,799
that and down below 1.5 it's it's

601
00:21:11,750 --> 00:21:09,600
infinitely far away

602
00:21:12,710 --> 00:21:11,760
so i'll place a link to this calculator

603
00:21:14,390 --> 00:21:12,720
so you can verify

604
00:21:16,310 --> 00:21:14,400
all this yourself but all the math is

605
00:21:18,070 --> 00:21:16,320
here just on the side panel

606
00:21:19,430 --> 00:21:18,080
it's all very straightforward you can do

607
00:21:22,390 --> 00:21:19,440
it yourself

608
00:21:23,510 --> 00:21:22,400
and it's a it's it's you know doing it

609
00:21:26,149 --> 00:21:23,520
with pencil and paper

610
00:21:28,070 --> 00:21:26,159
is great but it you you get one diagram

611
00:21:29,750 --> 00:21:28,080
and this way you can very easily

612
00:21:32,310 --> 00:21:29,760
experiment with differences and you can

613
00:21:33,270 --> 00:21:32,320

see what a lot of resistance difference

614
00:21:36,549 --> 00:21:33,280
a small

615
00:21:40,230 --> 00:21:38,710
so yeah probably lost most of the

616
00:21:41,990 --> 00:21:40,240
audience with that technical thing but

617
00:21:45,110 --> 00:21:42,000
if you're still here listening

618
00:21:46,789 --> 00:21:45,120
uh let's uh let's work it out

619
00:21:49,270 --> 00:21:46,799
let's figure out what's actually going

620
00:21:52,470 --> 00:21:49,280
on here i'm open to being wrong

621
00:21:53,110 --> 00:21:52,480
but i think i've raised a valid point

622
00:21:55,430 --> 00:21:53,120
here that