

A scenic view of a lake with a forested mountain in the background. A bright light reflects on the water's surface on the right side. The text 'LASER TESTS' is overlaid in large, bold, blue letters at the top.

LASER TESTS

ARE

MISLEADING

1
00:00:03,860 --> 00:00:01,790
in the flat earth community her popular

2
00:00:06,140 --> 00:00:03,870
experiment is shine a laser from a low

3
00:00:08,080 --> 00:00:06,150
height across a body of water and see if

4
00:00:11,330 --> 00:00:08,090
that laser is visible on the other side

5
00:00:13,280 --> 00:00:11,340
this seems like a reasonable test if you

6
00:00:15,499 --> 00:00:13,290
put the laser and the camera both a

7
00:00:17,990 --> 00:00:15,509
three feet above the water and they are

8
00:00:19,640 --> 00:00:18,000
say six miles apart then the laser

9
00:00:23,090 --> 00:00:19,650
should be hidden behind several feet of

10
00:00:24,950 --> 00:00:23,100
the curve of the earth and yet there are

11
00:00:27,109 --> 00:00:24,960
all these videos showing people doing

12
00:00:29,419 --> 00:00:27,119
this test sometimes over much longer

13
00:00:31,880 --> 00:00:29,429

distances and sometimes with a laser and

14

00:00:34,130 --> 00:00:31,890

the camera even closer to the water and

15

00:00:37,430 --> 00:00:34,140

yet in all these videos you can see the

16

00:00:40,430 --> 00:00:37,440

laser what does this mean is the earth

17

00:00:42,170 --> 00:00:40,440

flat no of course not the laser is

18

00:00:45,200 --> 00:00:42,180

simply bending around the curve of the

19

00:00:46,670 --> 00:00:45,210

earth due to refraction we've all seen

20

00:00:49,250 --> 00:00:46,680

refraction is the bending of light

21

00:00:51,560 --> 00:00:49,260

towards more dense air generally this

22

00:00:53,720 --> 00:00:51,570

goes one of two ways there's bending

23

00:00:56,060 --> 00:00:53,730

upwards if there's some low warmer air

24

00:01:01,670 --> 00:00:56,070

like a hot road or water that's warmer

25

00:01:07,440 --> 00:01:05,219

or it will be bending downwards which is

26

00:01:10,170 --> 00:01:07,450

what happens normally as lower air is

27

00:01:12,210 --> 00:01:10,180

generally denser than higher air this

28

00:01:14,999 --> 00:01:12,220

downwards bending is amplified if the

29

00:01:17,070 --> 00:01:15,009

lower air is cooler like if the water is

30

00:01:18,780 --> 00:01:17,080

cooler than the air which is normally

31

00:01:21,450 --> 00:01:18,790

the case during the day and in the

32

00:01:23,820 --> 00:01:21,460

evening in this case with light bending

33

00:01:25,590 --> 00:01:23,830

down towards cooler denser air the

34

00:01:27,450 --> 00:01:25,600

refraction can bend the light around the

35

00:01:30,080 --> 00:01:27,460

curve and so you can see the light from

36

00:01:32,460 --> 00:01:30,090

a laser that would normally be hidden

37

00:01:34,320 --> 00:01:32,470

but if we got these two cases like

38

00:01:36,059 --> 00:01:34,330

bending up and light bending down then

39

00:01:39,510 --> 00:01:36,069

why do the tests always show the laser

40

00:01:41,669 --> 00:01:39,520

visible well they actually don't if you

41

00:01:43,440 --> 00:01:41,679

follow these tests you'll see people are

42

00:01:46,050 --> 00:01:43,450

constantly unable to spot the laser

43

00:01:48,389 --> 00:01:46,060

which they quite correctly blame on the

44

00:01:49,710 --> 00:01:48,399

weather for example there's a recent

45

00:01:51,419 --> 00:01:49,720

test in Brighton where the light was

46

00:01:56,460 --> 00:01:51,429

bending upwards they could not see the

47

00:01:58,620 --> 00:01:56,470

laser now we've got another test asking

48

00:02:01,109 --> 00:01:58,630

can the intense source of a laser one

49

00:02:03,300 --> 00:02:01,119

meter above the water be recorded 9.5

50

00:02:05,819 --> 00:02:03,310

kilometres away by a camera one meter

51
00:02:06,569 --> 00:02:05,829
above the water level and the answer is

52
00:02:07,859 --> 00:02:06,579
yes

53
00:02:09,770 --> 00:02:07,869
of course it can why are you even doing

54
00:02:12,420 --> 00:02:09,780
this experiment don't you watch YouTube

55
00:02:13,650 --> 00:02:12,430
we've seen time again that lasers are

56
00:02:15,030 --> 00:02:13,660
often visible over water when

57
00:02:16,319 --> 00:02:15,040
geometrically they should be hidden

58
00:02:21,690 --> 00:02:16,329
biting the curve so there should be no

59
00:02:23,849 --> 00:02:21,700
surprise what's actually going on when

60
00:02:24,990 --> 00:02:23,859
you see a laser when you think you

61
00:02:26,670 --> 00:02:25,000
shouldn't well there's two things to

62
00:02:31,920 --> 00:02:26,680
consider a refraction and beam

63
00:02:35,009 --> 00:02:31,930

divergence no I wrote a refraction

64

00:02:37,140 --> 00:02:35,019

simulator and the refraction simulator

65

00:02:39,720 --> 00:02:37,150

basically does what it says it simulates

66

00:02:42,599 --> 00:02:39,730

refraction we have a picture and we have

67

00:02:44,009 --> 00:02:42,609

a temperature profile and and we've seen

68

00:02:46,229 --> 00:02:44,019

relate where all the beams of light go

69

00:02:50,210 --> 00:02:46,239

and this shows us the resultant image

70

00:02:52,800 --> 00:02:50,220

and you can move the temperature profile

71

00:02:55,349 --> 00:02:52,810

around and you can make it colder or

72

00:02:58,220 --> 00:02:55,359

warmer and you can see what effect that

73

00:03:00,660 --> 00:02:58,230

has and I have a setup

74

00:03:03,599 --> 00:03:00,670

for the Bedford level which is the site

75

00:03:07,460 --> 00:03:03,609

of the experiment I've referenced and I

76

00:03:10,860 --> 00:03:07,470

can load that here Bedford level boat

77

00:03:13,949 --> 00:03:10,870

this is a bridge which is six miles away

78

00:03:15,120 --> 00:03:13,959

that's a gain about is about four miles

79

00:03:17,640 --> 00:03:15,130

away I'm actually going to move

80

00:03:20,240 --> 00:03:17,650

I'm going to select him here man in boat

81

00:03:23,670 --> 00:03:20,250

I'm going to move him out so he's also

82

00:03:26,610 --> 00:03:23,680

at six miles so it's just about where

83

00:03:27,870 --> 00:03:26,620

the bridges okay Cece is being squished

84

00:03:30,060 --> 00:03:27,880

there because I'll see him

85

00:03:31,590 --> 00:03:30,070

now the Bueller here is only four feet

86

00:03:32,940 --> 00:03:31,600

above the water so really you shouldn't

87

00:03:35,610 --> 00:03:32,950

be able to see when in fact if we turn

88

00:03:38,820 --> 00:03:35,620

off refraction you'll see that he is in

89

00:03:40,890 --> 00:03:38,830

fact down below the horizon we can move

90

00:03:42,630 --> 00:03:40,900

them around move them back here and you

91

00:03:45,480 --> 00:03:42,640

can see he's actually there moving back

92

00:03:49,170 --> 00:03:45,490

out to six feet so I'll just put that in

93

00:03:50,910 --> 00:03:49,180

exactly six miles away and we can raise

94

00:03:52,830 --> 00:03:50,920

the viewer height so you can see what's

95

00:03:55,860 --> 00:03:52,840

going on we can go higher so we can

96

00:03:57,030 --> 00:03:55,870

actually see the guy down by by the

97

00:04:00,540 --> 00:03:57,040

bridge over there but let's move him

98

00:04:01,950 --> 00:04:00,550

back down so one meter that's about

99

00:04:05,160 --> 00:04:01,960

three feet so let's go down to about

100

00:04:07,410 --> 00:04:05,170

three feet and recently I added lasers

101
00:04:10,470 --> 00:04:07,420
to the mix to any refraction back on

102
00:04:13,290 --> 00:04:10,480
here and like I switch is on down here

103
00:04:15,270 --> 00:04:13,300
by default it will set a laser etched

104
00:04:19,140 --> 00:04:15,280
the camera so here's where the camera is

105
00:04:21,390 --> 00:04:19,150
here's where the bridge is the laser is

106
00:04:23,550 --> 00:04:21,400
a four feet here their cameras are three

107
00:04:24,870 --> 00:04:23,560
feet we can move the laser hide other

108
00:04:27,840 --> 00:04:24,880
places at five feet we can move the

109
00:04:28,920 --> 00:04:27,850
laser down we can move it up and this is

110
00:04:30,420 --> 00:04:28,930
kind of boring because we're just

111
00:04:32,850 --> 00:04:30,430
shining towards the guy in the boat

112
00:04:35,460 --> 00:04:32,860
let's flip the laser direction which

113
00:04:38,280 --> 00:04:35,470

will put the laser we'll put the laser

114

00:04:39,780 --> 00:04:38,290

at the the bridge show the guy at the

115

00:04:41,280 --> 00:04:39,790

boats here has to miss it at the

116

00:04:43,830 --> 00:04:41,290

furthest object I'm going to reduce the

117

00:04:46,380 --> 00:04:43,840

power of this laser is a bit too bright

118

00:04:49,920 --> 00:04:46,390

and you can see here's the laser in the

119

00:04:52,200 --> 00:04:49,930

boat it's at one point seven feet and

120

00:04:55,920 --> 00:04:52,210

I'll make that three feet so it's same

121

00:04:59,220 --> 00:04:55,930

as in the experiment so we've got a

122

00:05:01,200 --> 00:04:59,230

laser six miles away we have the viewer

123

00:05:02,550 --> 00:05:01,210

the camera a three feet we have the

124

00:05:05,550 --> 00:05:02,560

laser at three feet and the quite

125

00:05:08,490 --> 00:05:05,560

visible so why is this this this this

126

00:05:10,860 --> 00:05:08,500

thick green line here is the line of the

127

00:05:12,840 --> 00:05:10,870

laser which you know you see you're

128

00:05:15,000 --> 00:05:12,850

looking at it here it looks like it's

129

00:05:18,960 --> 00:05:15,010

actually going too high you wouldn't get

130

00:05:21,270 --> 00:05:18,970

to see it and what's actually happening

131

00:05:24,270 --> 00:05:21,280

though is the laser spreads out it

132

00:05:26,010 --> 00:05:24,280

spreads out by one milli radiant which

133

00:05:28,320 --> 00:05:26,020

is a thousandth of a radiant which is

134

00:05:29,790 --> 00:05:28,330

it's just a small fraction of a

135

00:05:33,029 --> 00:05:29,800

a degree which isn't really very very

136

00:05:35,129 --> 00:05:33,039

much it kind of looks like a lot here in

137

00:05:37,770 --> 00:05:35,139

this side view but that's because this

138

00:05:40,800 --> 00:05:37,780

side view is very very very very

139

00:05:42,089 --> 00:05:40,810

compressed horizontally or stretched

140

00:05:46,140 --> 00:05:42,099

vertically depending on which way you

141

00:05:49,740 --> 00:05:46,150

think of it and if I turn on the the

142

00:05:51,959 --> 00:05:49,750

zoom and if I set the zoom factor to one

143

00:05:54,179 --> 00:05:51,969

which means this is the actual actual

144

00:05:56,820 --> 00:05:54,189

site you'll see things look very very

145

00:05:58,080 --> 00:05:56,830

very flat the the earth of course you

146

00:06:00,869 --> 00:05:58,090

know it doesn't cook very much because

147

00:06:03,240 --> 00:06:00,879

it's so big so over six miles is hardly

148

00:06:07,080 --> 00:06:03,250

any curve it looks pretty much flat we

149

00:06:09,330 --> 00:06:07,090

can zoom in to reveal the curve and we

150

00:06:11,610 --> 00:06:09,340

can see this is the spread of the laser

151
00:06:13,860 --> 00:06:11,620
beam if I change the angle of the laser

152
00:06:15,899 --> 00:06:13,870
you'll see the green lines in the middle

153
00:06:18,029 --> 00:06:15,909
on those two green lines one on either

154
00:06:19,379 --> 00:06:18,039
side this is showing the divergence of a

155
00:06:23,730 --> 00:06:19,389
laser as I say it's been magnified

156
00:06:25,350 --> 00:06:23,740
because we were magnifying the curve so

157
00:06:27,540 --> 00:06:25,360
we can see what's going on so if I go

158
00:06:28,890 --> 00:06:27,550
back down to one it would actually look

159
00:06:29,969 --> 00:06:28,900
like that which you know it looks like a

160
00:06:32,850 --> 00:06:29,979
straight line but it's actually

161
00:06:35,610 --> 00:06:32,860
diverging very very slightly anyway so

162
00:06:38,399 --> 00:06:35,620
this laser beam starts over here and it

163
00:06:40,080 --> 00:06:38,409

goes in this direction and the bottom of

164

00:06:42,959 --> 00:06:40,090

it spreads to here and the top spreads

165

00:06:46,740 --> 00:06:42,969

to here so if it's angled down a little

166

00:06:49,800 --> 00:06:46,750

bit so it's down like it was before the

167

00:06:51,510 --> 00:06:49,810

top of the laser beam could be going way

168

00:06:53,610 --> 00:06:51,520

over the camera but the bottom of the

169

00:06:55,260 --> 00:06:53,620

laser beam is just touching the can we

170

00:06:57,209 --> 00:06:55,270

just managed to make it around the curve

171

00:06:59,969 --> 00:06:57,219

of the earth and you can see down here

172

00:07:02,790 --> 00:06:59,979

you can just see that beam start to come

173

00:07:05,550 --> 00:07:02,800

in so the divergence of the laser beam

174

00:07:07,379 --> 00:07:05,560

actually has quite a quite a significant

175

00:07:09,180 --> 00:07:07,389

effect and that it makes it very very

176

00:07:11,040 --> 00:07:09,190

easy to see the beam that kind of no

177

00:07:12,990 --> 00:07:11,050

matter what direction you're pointing it

178

00:07:15,029 --> 00:07:13,000

in like up or down because there's

179

00:07:17,010 --> 00:07:15,039

always going to be some light path which

180

00:07:22,170 --> 00:07:17,020

goes over just over the curve of the

181

00:07:26,339 --> 00:07:22,180

earth and we just get rid of this real

182

00:07:29,519 --> 00:07:26,349

quick just move it over here and I'll

183

00:07:30,809 --> 00:07:29,529

move this into a so you can see it a

184

00:07:32,869 --> 00:07:30,819

little bit better and I'm going to zoom

185

00:07:36,350 --> 00:07:32,879

in a bit more

186

00:07:37,939 --> 00:07:36,360

so here's the camera and here's where

187

00:07:41,570 --> 00:07:37,949

the laser is both there were three feet

188

00:07:43,669 --> 00:07:41,580

above the ground and there's even though

189

00:07:45,559 --> 00:07:43,679

the laser beam is shining up like this

190

00:07:48,439 --> 00:07:45,569

there's still a light path which goes

191

00:07:50,059 --> 00:07:48,449

from the laser to the camera and you can

192

00:07:51,739 --> 00:07:50,069

actually see that by moving this around

193

00:07:54,439 --> 00:07:51,749

here until we get to the laser so this

194

00:07:58,040 --> 00:07:54,449

yellow line here is a path that the

195

00:07:59,779 --> 00:07:58,050

laser takes now if we zoom down a little

196

00:08:02,149 --> 00:07:59,789

bit more here what the zoom taper tilts

197

00:08:04,189 --> 00:08:02,159

down a little bit more you'll see the

198

00:08:06,889 --> 00:08:04,199

laser will actually get brighter as the

199

00:08:10,969 --> 00:08:06,899

center of the beam goes closer and

200

00:08:12,799 --> 00:08:10,979

closer now why is it refracting around

201
00:08:16,159 --> 00:08:12,809
which because the the water is cooler

202
00:08:19,459 --> 00:08:16,169
and I've got this little graph here

203
00:08:21,379 --> 00:08:19,469
which shows this very very slight cool

204
00:08:23,299 --> 00:08:21,389
water then slightly warmer air and then

205
00:08:25,759 --> 00:08:23,309
just moving this is hardly anything this

206
00:08:29,239 --> 00:08:25,769
is about a tenth of a degree it really

207
00:08:32,779 --> 00:08:29,249
really does not take very much at all to

208
00:08:36,009 --> 00:08:32,789
get the actual results that we're

209
00:08:40,249 --> 00:08:36,019
looking for here now of course if the

210
00:08:41,540 --> 00:08:40,259
the air was you know even warmer then

211
00:08:43,939 --> 00:08:41,550
you get even more refraction or it

212
00:08:46,910 --> 00:08:43,949
becomes more visible but if the air is

213
00:08:50,030 --> 00:08:46,920

just a little bit cooler than the water

214

00:08:53,059 --> 00:08:50,040

the water is warmer then we don't see

215

00:08:57,139 --> 00:08:53,069

the laser so very very small variations

216

00:08:59,990 --> 00:08:57,149

can have quite a big effect we can see

217

00:09:01,790 --> 00:09:00,000

the laser here move this over here and

218

00:09:03,370 --> 00:09:01,800

you can't see it yeah you can see it you

219

00:09:05,360 --> 00:09:03,380

can't see it and this I'm just moving

220

00:09:07,519 --> 00:09:05,370

basically about a tenth of a degree

221

00:09:09,650 --> 00:09:07,529

either way so and it's only in the

222

00:09:11,840 --> 00:09:09,660

bottom ten feet or so and it could be

223

00:09:13,939 --> 00:09:11,850

even less I can focus down on the bottom

224

00:09:16,280 --> 00:09:13,949

like one or two feet and just very very

225

00:09:17,990 --> 00:09:16,290

small very very small adjustments in the

226

00:09:19,009 --> 00:09:18,000

temperature so because you don't

227

00:09:20,480 --> 00:09:19,019

actually know the temperature all the

228

00:09:22,129 --> 00:09:20,490

way along this path all the way along

229

00:09:24,290 --> 00:09:22,139

this six mile path it's actually quite

230

00:09:27,860 --> 00:09:24,300

difficult to figure out what's actually

231

00:09:29,240 --> 00:09:27,870

going on and actually what you see in

232

00:09:31,699 --> 00:09:29,250

terms of what the refraction is a better

233

00:09:33,069 --> 00:09:31,709

indication of what the temperature is

234

00:09:35,420 --> 00:09:33,079

along that path than the actual

235

00:09:39,949 --> 00:09:35,430

measurements you would make say let's

236

00:09:42,110 --> 00:09:39,959

start on the end of that path now you

237

00:09:44,530 --> 00:09:42,120

see here I put the laser in the boat and

238

00:09:46,640 --> 00:09:44,540

the reason I've got this boat here is

239

00:09:50,690 --> 00:09:46,650

the original rope

240

00:09:52,250 --> 00:09:50,700

I'm experiment back in the 1800's didn't

241

00:09:53,930 --> 00:09:52,260

have lasers back then of course you know

242

00:09:55,910 --> 00:09:53,940

which they just had guys in boats so

243

00:10:01,930 --> 00:09:55,920

what they did is they got a guy in a

244

00:10:06,820 --> 00:10:05,350

he started out here and he just rode his

245

00:10:09,070 --> 00:10:06,830

boat all the way over to the bridge and

246

00:10:11,050 --> 00:10:09,080

they looked at him from a telescope set

247

00:10:12,580 --> 00:10:11,060

3 feet away it might be 2 feet above the

248

00:10:14,200 --> 00:10:12,590

water line and they found that

249

00:10:16,420 --> 00:10:14,210

actually see on the hallway and this was

250

00:10:18,100 --> 00:10:16,430

because of course of refraction it's

251

00:10:20,230 --> 00:10:18,110

exactly the same thing here very slight

252

00:10:23,820 --> 00:10:20,240

difference in his slightly cooler water

253

00:10:28,180 --> 00:10:23,830

or much cooler water in the some cases

254

00:10:29,620 --> 00:10:28,190

let's you see around the curve of the

255

00:10:32,650 --> 00:10:29,630

earth because it's bending the light

256

00:10:34,960 --> 00:10:32,660

down so that wasn't a very good

257

00:10:36,760 --> 00:10:34,970

experiment back in the 1800s and the

258

00:10:41,740 --> 00:10:36,770

laser experiment right next to the water

259

00:10:43,690 --> 00:10:41,750

is not a very good experiment either so

260

00:10:45,250 --> 00:10:43,700

what should you do instead well you

261

00:10:48,700 --> 00:10:45,260

should use bigger things and you should

262

00:10:50,770 --> 00:10:48,710

use higher viewpoints get away from the

263

00:10:54,460 --> 00:10:50,780

random deviations of the laser being a

264

00:10:56,080 --> 00:10:54,470

few feet either way above above the

265

00:10:57,820 --> 00:10:56,090

surface of the water just grazing the

266

00:11:00,220 --> 00:10:57,830

horizon and try to look at the bigger

267

00:11:02,770 --> 00:11:00,230

picture use mountains and use tall

268

00:11:05,800 --> 00:11:02,780

buildings for example can you see all of

269

00:11:09,040 --> 00:11:05,810

Catalina Island from Santa Monica no you

270

00:11:11,350 --> 00:11:09,050

can't can you see all of San yaqeen no

271

00:11:13,810 --> 00:11:11,360

Jackie no mountain from Malibu no you

272

00:11:16,810 --> 00:11:13,820

can't can you see all of Toronto from

273

00:11:19,200 --> 00:11:16,820

across the lake no you can't can you see

274

00:11:24,010 --> 00:11:19,210

the curve of the earth from a plane from

275

00:11:25,420 --> 00:11:24,020

35,000 or 40,000 feet yes you can so

276

00:11:27,310 --> 00:11:25,430

these laser tests are fun and

277

00:11:29,650 --> 00:11:27,320

interesting demonstrations of refraction

278

00:11:32,020 --> 00:11:29,660

but the very misleading if you pretend

279

00:11:34,030 --> 00:11:32,030

refraction isn't happening to get the