1

00:00:00,000 --> 00:00:03,000

That's right folks, don't try this at home.

2

00:00:03,000 --> 00:00:05,000

We're what you call experts.

3

00:00:31,000 --> 00:00:35,000

Apparently a ping-pong ball can kill ya.

4

00:00:35,000 --> 00:00:40,000

Yep, duck, cover, and uh, dance?

5

00:00:40,000 --> 00:00:44,000

To tackle a duo of deadly ballistic mysteries.

6

00:00:44,000 --> 00:00:47,000

What the f***? Nothing's making any sense.

7

00:00:47,000 --> 00:00:50,000

The team engages in an arms race.

8

00:00:50,000 --> 00:00:51,000

It's just a flesh.

9

00:00:51,000 --> 00:00:53,000

Of incredible ingenuity.

10

00:00:53,000 --> 00:00:57,000

First, in a world record breaking attempt.

11

00:00:57,000 --> 00:00:59,000

This has never been done before.

12

00:01:00,000 --> 00:01:02,000

Wow, it's scary.

13

00:01:02,000 --> 00:01:06,000

Jamie and Adamas will ping-pong make a mortal mark.

14

00:01:06,000 --> 00:01:07,000

Go!

15

00:01:07,000 --> 00:01:11,000

That was an ever-loving smack of a bang.

16

00:01:11,000 --> 00:01:15,000

Then Carrie Grant and Tori feel the force.

17

00:01:15,000 --> 00:01:17,000

I am your father.

18

00:01:17,000 --> 00:01:20,000

In a Sarwar, will an ice cannon

19

00:01:20,000 --> 00:01:21,000

What?

20

00:01:21,000 --> 00:01:24,000

really blow the daft invaders away?

21

00:01:25,000 --> 00:01:28,000

What a drama here on the set of Mythbusters.

22

00:01:31,000 --> 00:01:33,000

Who are the Mythbusters?

23

00:01:33,000 --> 00:01:35,000

Adam Savage.

24

00:01:35,000 --> 00:01:37,000

I reject the reality and substitute my own.

25

00:01:37,000 --> 00:01:39,000

And Jamie Heineman.

26

00:01:39,000 --> 00:01:40,000

Bye-bye.

27

00:01:40,000 --> 00:01:45,000

Between them more than 30 years of special effects experience,

28

00:01:45,000 --> 00:01:47,000

together with Randy Mahara.

29

00:01:47,000 --> 00:01:48,000

That is crazy!

30

00:01:48,000 --> 00:01:50,000

Carrie Byron.

31

00:01:50,000 --> 00:01:51,000

I'm from Iowa.

32

00:01:51,000 --> 00:01:53,000

And Tori Bellachy.

33

00:01:53,000 --> 00:01:55,000

It's about to get real.

34

00:01:55,000 --> 00:01:57,000

They'll just tell the Myths.

35

00:01:57,000 --> 00:02:00,000

They put them to the test.

36

00:02:06,000 --> 00:02:09,000

First up, Adam and Jamie tackle the tall tale

37

00:02:09,000 --> 00:02:13,000

that ping-pong can go lethally wrong.

38

00:02:18,000 --> 00:02:19,000

Really?

39

00:02:19,000 --> 00:02:21,000

A ping-pong ball can kill you.

40

00:02:21,000 --> 00:02:22,000

That's the myth.

41

00:02:22,000 --> 00:02:26,000

There's no way it has enough mass to actually penetrate anything.

42

00:02:27,000 --> 00:02:29,000

18 to nothing.

43

00:02:29,000 --> 00:02:33,000

But what if the ball was going really, really fast?

44

00:02:33,000 --> 00:02:35,000

Enough already!

45

00:02:35,000 --> 00:02:37,000

It's an interesting physical conundrum.

46

00:02:37,000 --> 00:02:40,000

Can such a delicate object with so little mass

47

00:02:40,000 --> 00:02:43,000

achieve ballistic lethality?

48

00:02:43,000 --> 00:02:46,000

Is it possible to fire plastic ping-pong balls

49

00:02:46,000 --> 00:02:49,000

fast enough to result in mortal damage?

50

00:02:52,000 --> 00:02:55,000

So if you're thinking an itty bitty ping-pong ball can kill you,

51

00:02:55,000 --> 00:02:56,000

what's your plan?

52

00:02:56,000 --> 00:02:58,000

Well, force it.

53

00:02:58,000 --> 00:03:02,000

Equals mass times acceleration.

54

00:03:03,000 --> 00:03:04,000

Ah, I see.

55

00:03:04,000 --> 00:03:08,000

So what this lacks in mass you're hoping to make up for in speed.

56

00:03:08,000 --> 00:03:10,000

How fast you think it'll go?

57

00:03:10,000 --> 00:03:12,000

A lot. I'm thinking super-sonic.

58

00:03:14,000 --> 00:03:15,000

I love it.

59

00:03:15,000 --> 00:03:16,000

Where should we start?

60

00:03:16,000 --> 00:03:18,000

Human power.

61

00:03:18,000 --> 00:03:20,000

Go down, bat a few of these around and see how fast we can make them go?

62

00:03:20,000 --> 00:03:21,000

Yep.

63

00:03:21,000 --> 00:03:22,000

Sounds great.

64

00:03:22,000 --> 00:03:23,000

Whoops.

65

00:03:23,000 --> 00:03:27,000

Before the guys attempt to mechanically ramp it up to super-sonic,

66

00:03:27,000 --> 00:03:32,000

the minimum that Jamie thinks is required for a lethal hit

67

00:03:32,000 --> 00:03:36,000

are less than professional players

68

00:03:36,000 --> 00:03:41,000

have given the manual speed test everything they've got.

69

00:03:44,000 --> 00:03:48,000

So, Jamie was able to rocket the ball off his paddle at 68 miles an hour.

70

00:03:48,000 --> 00:03:51,000

I was able to do it at 75 miles per hour.

71

00:03:51,000 --> 00:03:54,000

Neither of those speeds anywhere close to lethal.

72

00:03:54,000 --> 00:03:57,000

And I have an idea for getting it to go a bit faster.

73

00:03:57,000 --> 00:03:59,000

Perfect.

74

00:03:59,000 --> 00:04:00,000

I'm going to build it.

75

00:04:00,000 --> 00:04:05,000

Their hands-on technique obviously failed to fuel a fatal force.

76

00:04:05,000 --> 00:04:10,000

So Adam puts together an air-pressure-powered ping-pong pop gun.

77

00:04:10,000 --> 00:04:13,000

Here's how this works.

78

00:04:13,000 --> 00:04:15,000

This is what I call a breach-loading pop gun.

79

00:04:15,000 --> 00:04:16,000

Here's the breach.

80

00:04:16,000 --> 00:04:17,000

There's the ammo.

81

00:04:17,000 --> 00:04:18,000

Seal it up.

82

00:04:18,000 --> 00:04:20,000

Pressurize from here.

83

00:04:20,000 --> 00:04:21,000

Open it up.

84

00:04:21,000 --> 00:04:23,000

Point it in the direction you want to hit with a ping-pong ball.

85

00:04:23,000 --> 00:04:26,000

Release with this high-pressure valve.

86

00:04:26,000 --> 00:04:28,000

And bob your uncle.

87

00:04:28,000 --> 00:04:29,000

What does bob's your uncle mean?

88

00:04:29,000 --> 00:04:31,000

Well, it means hopefully that we've gotten the ping-pong ball

89

00:04:31,000 --> 00:04:33,000

to an impossibly large speed.

90

00:04:33,000 --> 00:04:35,000

And with the pressure pumped to the max,

91

00:04:35,000 --> 00:04:39,000

the pop gun can handle a modest 95 psi in three.

92

00:04:39,000 --> 00:04:41,000

We're about to find out.

93

00:04:42,000 --> 00:04:45,000

140 miles per hour.

94

00:04:46,000 --> 00:04:48,000

Nice for a little device like that.

95

00:04:50,000 --> 00:04:51,000

There we go.

96

00:04:55,000 --> 00:04:56,000

It's not lethal though.

97

00:04:56,000 --> 00:04:59,000

We've got a long ways to go before we get to that point.

98

00:04:59,000 --> 00:05:00,000

Yep.

99

00:05:00,000 --> 00:05:04,000

As Brody would say, they're going to need a bigger barrel.

100

00:05:04,000 --> 00:05:07,000

Our paddle's got the ping-pong balls to about 70 miles an hour.

101

00:05:07,000 --> 00:05:08,000

My little shooter here.

102

00:05:08,000 --> 00:05:10,000

Up to 140.

103

00:05:10,000 --> 00:05:13,000

Wait a second, editors, can you give me a nice shotgun sound effect for this?

104

00:05:13,000 --> 00:05:14,000

Much better.

105

00:05:14,000 --> 00:05:19,000

Got the ping-pong ball up to 140 miles an hour at 100 psi.

106

00:05:19,000 --> 00:05:21,000

Jamie's in my experience.

107

00:05:21,000 --> 00:05:24,000

PSI is not the deciding factor for acceleration in an air cannon.

108

00:05:24,000 --> 00:05:25,000

It's barrel length.

109

00:05:25,000 --> 00:05:28,000

So I think what we need to do is build another one of these

110

00:05:28,000 --> 00:05:31,000

with a really, really long barrel.

111

00:05:35,000 --> 00:05:41,000

Up next, an age-old ice-cold ballistics mystery from history.

112

00:05:42,000 --> 00:05:44,000

Well, I hope you guys packed your thermals

113

00:05:44,000 --> 00:05:48,000

because this myth comes from the depths of winter in medieval Russia.

114

00:05:48,000 --> 00:05:50,000

Now, there was a town that was under siege,

115

00:05:50,000 --> 00:05:52,000

and they didn't have anything to defend themselves with.

116

00:05:52,000 --> 00:05:57,000

So they improvised a cannon and cannonballs out of the one thing they had plenty of.

117

00:05:57,000 --> 00:05:58,000

Ice.

118

00:05:58,000 --> 00:05:59,000

Really? Just ice?

119

00:05:59,000 --> 00:06:02,000

Yes, ice, possibly some materials to strengthen it,

120

00:06:02,000 --> 00:06:05,000

but the history books say it was a viable defensive weapon.

121

00:06:05,000 --> 00:06:08,000

Well, the good news is, if there's another ice age

122

00:06:08,000 --> 00:06:11,000

when the zombie apocalypse happens, we'll have something to fight them off with.

123

00:06:11,000 --> 00:06:15,000

Well, it's really good to be prepared for everything.

124

00:06:15,000 --> 00:06:16,000

I'm always prepared.

125

00:06:17,000 --> 00:06:22,000

Supposedly, in the ultimate test of backs-to-the-wall improvised ingenuity,

126

00:06:22,000 --> 00:06:29,000

the Cossacks crafted a cannon out of the most unlikely material imaginable, frozen water.

127

00:06:29,000 --> 00:06:32,000

All right, now you remember a million years ago,

128

00:06:32,000 --> 00:06:35,000

when we first started on the show, we tested ice bullets.

129

00:06:35,000 --> 00:06:38,000

And as soon as we shot the rifle, the bullet turned to gases.

130

00:06:38,000 --> 00:06:43,000

Which is exactly why I think that before we go and build a full-size ice cannon,

131

00:06:43,000 --> 00:06:45,000

we should start by testing the cannonballs.

132

00:06:45,000 --> 00:06:49,000

Right, because if the cannonballs can't hold together, then the myth is already busted.

133

00:06:49,000 --> 00:06:52,000

Exactly. So why don't we do this? Let's make some ice cannonballs,

134

00:06:52,000 --> 00:06:55,000

we'll fire them out of a real cannon, and take it from there.

135

00:06:55,000 --> 00:06:56,000

Good. I like it.

136

00:06:56,000 --> 00:07:01,000

The team's previous failure firing frozen H2O ammo...

137

00:07:01,000 --> 00:07:04,000

It just can't be done. You're going to end up with vaporized water.

138

00:07:04,000 --> 00:07:10,000

...means the opening salvo in this Siberian siege story will be the weakest link.

139

00:07:10,000 --> 00:07:12,000

The projectiles themselves.

140

00:07:12,000 --> 00:07:18,000

We've done a lot of research to see if we could find any sort of historical information on the specs of the ice cannonballs.

141

00:07:18,000 --> 00:07:24,000

Now, we've found that they may have been reinforced with fibers such as hemp, wood, and paper pulp.

142

00:07:24,000 --> 00:07:27,000

So while Tori and I work on these supplemented cannonballs,

143

00:07:27,000 --> 00:07:29,000

Grant's going to work on the clear ice ones.

144

00:07:29,000 --> 00:07:32,000

What is going on back here?

145

00:07:32,000 --> 00:07:37,000

So using natural materials for structurally stronger alternatives...

146

00:07:37,000 --> 00:07:38,000

Sausage.

147

00:07:38,000 --> 00:07:42,000

...the team makes four types of frozen cannonballs.

148

00:07:42,000 --> 00:07:46,000

Yeah, there's going to be one strong cannonball.

149

00:07:46,000 --> 00:07:47,000

Pure ice...

150

00:07:47,000 --> 00:07:48,000

Perfect.

151

00:07:48,000 --> 00:07:49,000

...and ice plus hemp...

152

00:07:49,000 --> 00:07:52,000

Ice ball with hemp in it.

153

00:07:52,000 --> 00:07:53,000

Sausage and paper.

154

00:07:53,000 --> 00:07:58,000

Whoa, that is awesome. Look at how perfect that is.

155

00:07:58,000 --> 00:08:03,000

With their projectiles prepped, it's off to a suitably explosive location.

156

00:08:03,000 --> 00:08:06,000

Alright, let's bring out the cannon.

157

00:08:06,000 --> 00:08:07,000

Alright.

158

00:08:07,000 --> 00:08:13,000

Harry Webb has brought out Old Moses so that we can test each recipe for our ice cannonballs

159

00:08:13,000 --> 00:08:17,000

and see which one can withstand the blast of a real cannon.

160

00:08:17,000 --> 00:08:21,000

We're going to be firing our cannonballs with increasingly larger amounts of black powder

161

00:08:21,000 --> 00:08:24,000

to see if they can withstand the pressure.

162

00:08:24,000 --> 00:08:28,000

We're starting with pure ice cannonballs and eight ounces of black powder,

163

00:08:28,000 --> 00:08:32,000

the minimum amount we can use in the cannon.

164

00:08:32,000 --> 00:08:35,000

Don't worry, comrade. They're only shooting ice.

165

00:08:35,000 --> 00:08:39,000

How bad could that hurt? We'll use it to chill our vodka.

166

00:08:39,000 --> 00:08:43,000

We've set up our grid to collect some data on speed and also added a target.

167

00:08:43,000 --> 00:08:46,000

Hey, come on, let's go dance in the battle.

168

00:08:46,000 --> 00:08:49,000

So it's all go for test one.

169

00:08:49,000 --> 00:08:50,000

We're loaded.

170

00:08:50,000 --> 00:08:52,000

Loaded, yay!

171

00:08:52,000 --> 00:09:00,000

Pure ice cannonball and half a pound of black powder with a potential muzzle energy of 20,000 joules.

172

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

Eyes and ears?

173

00:09:01,000 --> 00:09:06,000

Surely it doesn't stand a snowball's chance in hell of surviving.

174

00:09:06,000 --> 00:09:07,000

Wearing three.

175

00:09:07,000 --> 00:09:11,000

Let alone doing any damage to our dancing dummy.

176

00:09:11,000 --> 00:09:12,000

One.

177

00:09:13,000 --> 00:09:15,000

That was awesome.

178

00:09:15,000 --> 00:09:18,000

That looked like a very successful hit.

179

00:09:19,000 --> 00:09:22,000

That looks like we hit the bad guy.

180

00:09:22,000 --> 00:09:24,000

Ha ha, knocked him down.

181

00:09:26,000 --> 00:09:27,000

I am totally shocked.

182

00:09:27,000 --> 00:09:31,000

Not only did the pure ice cannonball come out completely intact,

183

00:09:31,000 --> 00:09:36,000

but it was traveling a thousand feet per second, or 680 miles an hour.

184

00:09:36,000 --> 00:09:42,000

That means if we aim our cannon just a little bit up, we can travel an incredible distance.

185

00:09:42,000 --> 00:09:45,000

It is an incredible result.

186

00:09:46,000 --> 00:09:50,000

The mighty power of old Moses couldn't part the frozen water.

187

00:09:50,000 --> 00:09:56,000

It stayed intact and hit the target at a lethal 680 miles per hour.

188

00:09:56,000 --> 00:09:59,000

Sorry my friend, I guess we underestimated the ice.

189

00:09:59,000 --> 00:10:06,000

And such an impressive result means the myth can proceed in its purest form without supplementary materials.

190

00:10:06,000 --> 00:10:11,000

The question is, how fast can pure H2O go?

191

00:10:11,000 --> 00:10:14,000

We're going to go up to a pound and a half of black powder,

192

00:10:14,000 --> 00:10:16,000

which is the most this cannon can handle.

193

00:10:16,000 --> 00:10:18,000

Let's see what happens.

194

00:10:18,000 --> 00:10:20,000

Three, two, one.

195

00:10:23,000 --> 00:10:25,000

Oh yeah!

196

00:10:28,000 --> 00:10:32,000

Old Moses supplies the biggest boom he can handle.

197

00:10:33,000 --> 00:10:39,000

And with the top speed topping out at an astonishing 1550 miles per hour,

198

00:10:39,000 --> 00:10:42,000

the ice has exceeded all expectations.

199

00:10:44,000 --> 00:10:48,000

Coming up is bigger, really better.

200

00:10:49,000 --> 00:10:51,000

That's big.

201

00:10:56,000 --> 00:10:57,000

Welcome back.

202

00:10:58,000 --> 00:11:00,000

Jamie the paddle says,

203

00:11:01,000 --> 00:11:08,000

we've effectively been attempting to weaponize the 1 tenth of an ounce ping pong ball and make it lethal.

204

00:11:08,000 --> 00:11:10,000

So we started out smacking them with rackets as hard as we can,

205

00:11:10,000 --> 00:11:13,000

and came up with about 75 miles per hour off the racket.

206

00:11:13,000 --> 00:11:16,000

So I built this little baby right here.

207

00:11:16,000 --> 00:11:21,000

And at 90 psi we were able to shoot ping pong balls from this at 140 miles per hour.

208

00:11:21,000 --> 00:11:23,000

Still not really lethal.

209

00:11:23,000 --> 00:11:27,000

But continuing along this theme, we figure if we make something that's a little bigger,

210

00:11:27,000 --> 00:11:29,000

my little pop gun,

211

00:11:29,000 --> 00:11:33,000

say 20 times this big, we might get some real results.

212

00:11:33,000 --> 00:11:39,000

So in an attempt to do some deadly damage, Adam and Jamie are going to extreme lengths.

213

00:11:40,000 --> 00:11:41,000

Coming along nicely.

214

00:11:41,000 --> 00:11:43,000

80 feet to be exact.

215

00:11:43,000 --> 00:11:48,000

And exactly why, well, a Heinemann walks into a bar and says,

216

00:11:48,000 --> 00:11:49,000

So why the long barrel?

217

00:11:49,000 --> 00:11:53,000

Well as long as the pressure behind the ball is greater than the pressure in front of the ball,

218

00:11:53,000 --> 00:11:56,000

the ball is going to continue to accelerate.

219

00:11:56,000 --> 00:11:57,000

Perfect.

220

00:11:57,000 --> 00:12:02,000

And so the longer the barrel we have, the more time the ball will have to do that,

221

00:12:02,000 --> 00:12:05,000

and the faster it will be going when it comes out the far end.

222

00:12:06,000 --> 00:12:07,000

There's the target.

223

00:12:07,000 --> 00:12:12,000

And with a pop gun pressurized to the max, the shop air can supply.

224

00:12:12,000 --> 00:12:14,000

Okay, that's 140 psi.

225

00:12:14,000 --> 00:12:15,000

It's time to load.

226

00:12:15,000 --> 00:12:18,000

These are some professional grade ping pong balls.

227

00:12:18,000 --> 00:12:19,000

And lock.

228

00:12:19,000 --> 00:12:20,000

Close the breach.

229

00:12:20,000 --> 00:12:21,000

And let rip.

230

00:12:21,000 --> 00:12:22,000

Range is hot.

231

00:12:23,000 --> 00:12:24,000

Firing.

232

00:12:24,000 --> 00:12:26,000

Three, two, one.

233

00:12:26,000 --> 00:12:29,000

I just see a hole at the other end.

234

00:12:36,000 --> 00:12:37,000

Wow.

235

00:12:37,000 --> 00:12:39,000

That is far out.

236

00:12:39,000 --> 00:12:42,000

That's a fast little ping pong ball.

237

00:12:42,000 --> 00:12:43,000

Wow.

238

00:12:45,000 --> 00:12:51,000

Well, our 80 foot long barrel sent this ping pong ball through an inch thick piece of honeycomb cardboard,

239

00:12:51,000 --> 00:12:54,000

which in and of itself is not that incredible a feat,

240

00:12:54,000 --> 00:12:57,000

but it left a visible mark on three quarter inch plywood.

241

00:12:57,000 --> 00:12:59,000

That is something more than I expected.

242

00:12:59,000 --> 00:13:02,000

It certainly banged up the backboard.

243

00:13:02,000 --> 00:13:04,000

But what about the crunch numbers?

244

00:13:06,000 --> 00:13:09,000

453 miles per hour.

245

00:13:09,000 --> 00:13:11,000

That's a good place to start.

246

00:13:11,000 --> 00:13:12,000

Absolutely.

247

00:13:14,000 --> 00:13:17,000

So we got this ball going 453 miles per hour.

248

00:13:17,000 --> 00:13:19,000

That's really fast, but I have to say,

249

00:13:19,000 --> 00:13:21,000

I don't think it's lethal.

250

00:13:21,000 --> 00:13:23,000

Based on what I'm seeing with this ball,

251

00:13:23,000 --> 00:13:24,000

it might break a rib.

252

00:13:24,000 --> 00:13:27,000

It might give you a really nasty bruise,

253

00:13:27,000 --> 00:13:29,000

but it's not going to kill you.

254

00:13:30,000 --> 00:13:32,000

So to make a mortal mark,

255

00:13:32,000 --> 00:13:34,000

they're going to need more speed,

256

00:13:34,000 --> 00:13:35,000

more momentum,

257

00:13:35,000 --> 00:13:37,000

and a step into the unknown.

258

00:13:38,000 --> 00:13:40,000

This has never been done before.

259

00:13:40,000 --> 00:13:42,000

It's scary.

260

00:13:42,000 --> 00:13:43,000

Cary.

261

00:13:47,000 --> 00:13:50,000

Cary, Grant and Tory are testing the ultimate in

262

00:13:50,000 --> 00:13:53,000

Backs to the Wall Ballistics Ingenuity.

263

00:13:53,000 --> 00:13:55,000

And so far,

264

00:13:55,000 --> 00:13:57,000

Don't worry, comrade.

265

00:13:57,000 --> 00:14:00,000

It's all go on the fro blow.

266

00:14:00,000 --> 00:14:03,000

Sorry, my friend, I guess we underestimated the ice.

267

00:14:03,000 --> 00:14:05,000

The team has the balls.

268

00:14:05,000 --> 00:14:07,000

Now to build the barrel.

269

00:14:08,000 --> 00:14:11,000

Now what I have here is a giant cardboard tube.

270

00:14:13,000 --> 00:14:15,000

Everybody okay?

271

00:14:15,000 --> 00:14:18,000

Now this is how we're going to make our ice cannons.

272

00:14:18,000 --> 00:14:21,000

This is the mold that we're going to fill up with water

273

00:14:21,000 --> 00:14:23,000

and let it freeze so we can make our cannons.

274

00:14:23,000 --> 00:14:26,000

So I'm going to build a couple of different sizes,

275

00:14:26,000 --> 00:14:28,000

and we're going to see which one is the strongest

276

00:14:28,000 --> 00:14:31,000

to withstand the exploding black powder.

277

00:14:31,000 --> 00:14:35,000

Yep, when it comes to cannons, size really does matter.

278

00:14:35,000 --> 00:14:38,000

The breach, that is the explosive chamber at the base of the barrel,

279

00:14:38,000 --> 00:14:42,000

has to contain and channel the energy of the black powder blast.

280

00:14:42,000 --> 00:14:44,000

So to find the optimal dimension,

281

00:14:44,000 --> 00:14:49,000

Tory is building three breaches with four, six and eight inch walls

282

00:14:49,000 --> 00:14:53,000

and diameters of 12, 16 and 20 inches.

283

00:14:53,000 --> 00:14:56,000

Too thin and it'll explode.

284

00:14:56,000 --> 00:15:01,000

Too thick and the mass becomes structurally prohibitive to move around.

285

00:15:01,000 --> 00:15:04,000

Alright, so now that the tubes are filled up with water,

286

00:15:04,000 --> 00:15:07,000

we just need to let them freeze and then we'll have our breaches.

287

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

And one week later, the ice cold cannons are ready for a refrigerated trip to the bomb range.

288

00:15:15,000 --> 00:15:17,000

This is going to be fun.

289

00:15:17,000 --> 00:15:22,000

So we now know that half a pound of black powder is enough to propel our ice cannonball

290

00:15:22,000 --> 00:15:26,000

at 680 miles per hour, which should give us enough range

291

00:15:26,000 --> 00:15:29,000

and enough damage to be a viable weapon.

292

00:15:29,000 --> 00:15:31,000

Now what we need to do is work on the breach.

293

00:15:31,000 --> 00:15:33,000

God, it would suck if this thing fell.

294

00:15:33,000 --> 00:15:38,000

We have a four inch wall, a six inch wall and an eight inch wall.

295

00:15:38,000 --> 00:15:43,000

We'll put our half pound of black powder in there and see which one of these, if any,

296

00:15:43,000 --> 00:15:47,000

is able to survive the kinds of forces that are generated in a cannon.

297

00:15:47,000 --> 00:15:51,000

First up is the 20 inch breach with eight inch walls.

298

00:15:51,000 --> 00:15:53,000

Don't let go.

299

00:15:53,000 --> 00:15:57,000

Oh my God!

300

00:15:57,000 --> 00:16:02,000

We're surviving the half pound black powder blast may not be the only issue.

301

00:16:02,000 --> 00:16:07,000

I gotta tell you, I can see some problems with working with ice.

302

00:16:07,000 --> 00:16:12,000

Yeah, I don't know how these guys would have been able to actually maneuver an ice cannon.

303

00:16:12,000 --> 00:16:14,000

Mass is a big concern.

304

00:16:14,000 --> 00:16:18,000

The larger it is, the harder it'll be to build, move and manipulate.

305

00:16:18,000 --> 00:16:21,000

Plus, even in the deepest midwinter...

306

00:16:21,000 --> 00:16:22,000

Loading the charge now.

307

00:16:22,000 --> 00:16:29,000

Due to the insulating properties of ice, freezing large amounts of water takes a long time.

308

00:16:29,000 --> 00:16:31,000

Alright, we're set. Let's go to the bunker.

309

00:16:31,000 --> 00:16:35,000

Meaning the smallest breach that can contain the blast will be the best option.

310

00:16:35,000 --> 00:16:41,000

So with the black powder loaded and no projectile, which barrel will survive?

311

00:16:41,000 --> 00:16:48,000

Alright, this is 20 inch diameter breach in three, two, one.

312

00:16:50,000 --> 00:16:55,000

Well, we just figured out a way to make hail instantly.

313

00:16:55,000 --> 00:16:57,000

Giant snow cone.

314

00:16:57,000 --> 00:17:01,000

Now that did not go according to plan.

315

00:17:01,000 --> 00:17:03,000

That's not gonna work.

316

00:17:03,000 --> 00:17:07,000

That is the thickest wall we have.

317

00:17:07,000 --> 00:17:10,000

Right now, it is not looking good for the myth.

318

00:17:10,000 --> 00:17:13,000

But you know what? Maybe we're using too much black powder.

319

00:17:13,000 --> 00:17:20,000

Maybe we need to find the perfect amount of black powder to launch the cannonball and not destroy our cannon.

320

00:17:21,000 --> 00:17:30,000

So with a few more freshly frozen 20 inch breaches, the team decides a little less boom is required and not more ice.

321

00:17:32,000 --> 00:17:38,000

They're scaling down the black powder from 8 to a mere 1.25 ounces.

322

00:17:38,000 --> 00:17:41,000

If the 20 inch breach can handle this...

323

00:17:41,000 --> 00:17:43,000

Alright, our cannon is hot.

324

00:17:43,000 --> 00:17:45,000

The myth is surely busted.

325

00:17:45,000 --> 00:17:48,000

In three, two, one.

326

00:17:48,000 --> 00:17:50,000

I think it did it. It worked.

327

00:17:50,000 --> 00:17:53,000

We shot the plug out without blowing up the breach.

328

00:17:53,000 --> 00:17:57,000

It was a somewhat less than big boom, but it's a start.

329

00:17:57,000 --> 00:18:01,000

Our breach hasn't exploded. It's still intact, which means it's reusable.

330

00:18:01,000 --> 00:18:04,000

We're gonna keep going. 1.75s next.

331

00:18:04,000 --> 00:18:06,000

Alright, ice breach locked and loaded.

332

00:18:06,000 --> 00:18:07,000

Let's do this.

333

00:18:07,000 --> 00:18:10,000

In three, two, one.

334

00:18:11,000 --> 00:18:13,000

Woo-hoo!

335

00:18:14,000 --> 00:18:19,000

Now that was more impressive, but can a brand new breach contain two ounces?

336

00:18:19,000 --> 00:18:24,000

Two ounces. In three, two, one.

337

00:18:24,000 --> 00:18:26,000

Oh.

338

00:18:26,000 --> 00:18:30,000

Alright, it looks like that was too much. I guess 1.75 ounces. That's the perfect amount.

339

00:18:31,000 --> 00:18:34,000

Yeah, two is just a bit too much.

340

00:18:35,000 --> 00:18:39,000

So, we've got the ball. We've got the amount of black powder.

341

00:18:39,000 --> 00:18:42,000

We've got the size of the breach. You know what that means?

342

00:18:42,000 --> 00:18:46,000

That means it's time to build a full-size cannon and go for it.

343

00:18:46,000 --> 00:18:47,000

Later.

344

00:18:47,000 --> 00:18:49,000

Okay, well, ooh, f***.

345

00:18:49,000 --> 00:18:51,000

The game of moans.

346

00:18:51,000 --> 00:18:53,000

What the f***? Nothing's making any sense.

347

00:18:53,000 --> 00:18:55,000

Continues.

348

00:18:55,000 --> 00:18:57,000

Ah.

349

00:19:02,000 --> 00:19:03,000

1.

350

00:19:03,000 --> 00:19:09,000

Adam and Jamie have a super-sized ping-pong pop gun, and they're not afraid to use it.

351

00:19:11,000 --> 00:19:17,000

But while shooting aesthetically pleasing objects at 450 miles an hour is impressive,

352

00:19:17,000 --> 00:19:21,000

they've determined the resulting destruction is less than lethal.

353

00:19:22,000 --> 00:19:23,000

So, what next?

354

00:19:23,000 --> 00:19:27,000

It might break a rib, but it's not going to kill you.

355

00:19:27,000 --> 00:19:33,000

Well, Adam has chance to put a cutting-edge resource called the Internet.

356

00:19:34,000 --> 00:19:36,000

It's amazing.

357

00:19:36,000 --> 00:19:41,000

It turns out that physics teachers have been getting incredible acceleration out of ping-pong balls

358

00:19:41,000 --> 00:19:46,000

without using 80-foot-long barrels, and I think it's a method that we should investigate immediately.

359

00:19:48,000 --> 00:19:49,000

Okay, cool.

360

00:19:49,000 --> 00:19:50,000

It's working alright.

361

00:19:50,000 --> 00:19:55,000

What they've been doing is they've been taking a 36-inch-long tube of PVC,

362

00:19:55,000 --> 00:19:58,000

and they've been putting a ping-pong ball in one end.

363

00:19:58,000 --> 00:20:02,000

Then they put packing tape over each end of the tube,

364

00:20:02,000 --> 00:20:07,000

and they use a vacuum to draw a full vacuum in that tube.

365

00:20:07,000 --> 00:20:08,000

Okay.

366

00:20:08,000 --> 00:20:09,000

There we go.

367

00:20:09,000 --> 00:20:10,000

Pulling the vacuum.

368

00:20:11,000 --> 00:20:16,000

Then when they pierce that side, of course, air wants to rush in to fill the vacuum,

369

00:20:16,000 --> 00:20:19,000

but the ping-pong ball's in the way, so it starts to move forward.

370

00:20:19,000 --> 00:20:21,000

Just everyone back off a little bit.

371

00:20:22,000 --> 00:20:26,000

There's nothing in its way in terms of air because there's a vacuum,

372

00:20:26,000 --> 00:20:32,000

and so it bursts out of this side at something over 300 miles per hour.

373

00:20:33,000 --> 00:20:34,000

That's the theory.

374

00:20:35,000 --> 00:20:36,000

Here we go.

375

00:20:37,000 --> 00:20:39,000

Whoa!

376

00:20:42,000 --> 00:20:43,000

Holy s***!

377

00:20:43,000 --> 00:20:45,000

Ha ha ha ha ha!

378

00:20:47,000 --> 00:20:50,000

Oh man, that was really good.

379

00:20:51,000 --> 00:20:54,000

I didn't expect it to work that well.

380

00:20:54,000 --> 00:20:57,000

The three-foot prototype worked scarily well.

381

00:20:59,000 --> 00:21:03,000

Popping the sealed vacuum caused a sudden influx of air,

382

00:21:03,000 --> 00:21:06,000

and the pressure differential sends the ball rocketing.

383

00:21:09,000 --> 00:21:11,000

And after a few technique tweaks...

384

00:21:11,000 --> 00:21:12,000

What?

385

00:21:13,000 --> 00:21:14,000

One.

386

00:21:15,000 --> 00:21:17,000

And a double barrel length...

387

00:21:18,000 --> 00:21:19,000

One.

388

00:21:21,000 --> 00:21:23,000

Adam measures rocketing at...

389

00:21:24,000 --> 00:21:26,000

375 miles an hour.

390

00:21:26,000 --> 00:21:28,000

That is mighty respectable.

391

00:21:28,000 --> 00:21:33,000

Respectable enough to be the new ping-pong projectile power of choice.

392

00:21:34,000 --> 00:21:38,000

Well, the vacuum trick for launching a ping-pong ball out of a short length of tubing

393

00:21:38,000 --> 00:21:40,000

is working gangbusters.

394

00:21:40,000 --> 00:21:45,000

We actually got 375 miles an hour on a ping-pong ball out of this measly six-foot tube.

395

00:21:45,000 --> 00:21:49,000

That is awesome, and this is where I'm going to concentrate my energy

396

00:21:49,000 --> 00:21:51,000

to get the fastest ping-pong ball possible.

397

00:21:52,000 --> 00:21:53,000

Alright, we're ready.

398

00:21:53,000 --> 00:21:56,000

Based on the theory that bigger barrels are better...

399

00:21:59,000 --> 00:22:01,000

It's taking a little longer to pump this out.

400

00:22:01,000 --> 00:22:02,000

Yeah.

401

00:22:02,000 --> 00:22:06,000

The guys have rigged the vacuum pump to their enormous 80-footer.

402

00:22:06,000 --> 00:22:08,000

There's plenty of nerves.

403

00:22:08,000 --> 00:22:10,000

This has never been done before.

404

00:22:11,000 --> 00:22:12,000

It's scary.

405

00:22:13,000 --> 00:22:14,000

High expectations.

406

00:22:15,000 --> 00:22:16,000

Here's a world first.

407

00:22:17,000 --> 00:22:20,000

And energy waiting to fulfill its potential.

408

00:22:20,000 --> 00:22:24,000

Ping-pong bazooka in 3, 2, 1.

409

00:22:25,000 --> 00:22:29,000

But it's an unexpected and disappointing dud.

410

00:22:29,000 --> 00:22:30,000

That's no good.

411

00:22:31,000 --> 00:22:32,000

Here's our ping-pong ball.

412

00:22:33,000 --> 00:22:36,000

That wall is where we want the ping-pong ball to be embedded in.

413

00:22:36,000 --> 00:22:37,000

One.

414

00:22:39,000 --> 00:22:40,000

Something's now working.

415

00:22:41,000 --> 00:22:43,000

But it's reaching close to the end of our tube,

416

00:22:43,000 --> 00:22:45,000

and then somehow bouncing back a little.

417

00:22:45,000 --> 00:22:46,000

Well, not somehow.

418

00:22:47,000 --> 00:22:50,000

The air rushes in this tube behind the ping-pong ball.

419

00:22:50,000 --> 00:22:51,000

There's a vacuum in front of it,

420

00:22:51,000 --> 00:22:53,000

but that air sneaks past the ping-pong ball,

421

00:22:53,000 --> 00:22:55,000

and it looks like it's providing a cushion

422

00:22:55,000 --> 00:22:58,000

that's actually causing it to spring back once it reaches the end.

423

00:22:58,000 --> 00:23:01,000

So it's not attaining enough speed or momentum to bust out.

424

00:23:01,000 --> 00:23:02,000

One.

425

00:23:03,000 --> 00:23:04,000

Nope.

426

00:23:05,000 --> 00:23:06,000

Didn't make it.

427

00:23:06,000 --> 00:23:09,000

It tells me that we've made this tube too long.

428

00:23:09,000 --> 00:23:12,000

Yep, that cushion of air decelerates the ball

429

00:23:12,000 --> 00:23:16,000

to the point that it doesn't have the force to pop the packing tape.

430

00:23:17,000 --> 00:23:21,000

So as Brody wouldn't say, they need a shorter barrel.

431

00:23:21,000 --> 00:23:23,000

Question is, how short?

432

00:23:23,000 --> 00:23:24,000

We're going to use the high-speed camera

433

00:23:24,000 --> 00:23:28,000

to find out where the ping-pong ball is no longer accelerating.

434

00:23:28,000 --> 00:23:30,000

They're going to cut the barrel there,

435

00:23:30,000 --> 00:23:32,000

and hope that that works.

436

00:23:32,000 --> 00:23:34,000

All right, speed test. Here we go.

437

00:23:34,000 --> 00:23:36,000

Three, two, one.

438

00:23:36,000 --> 00:23:38,000

Several tests.

439

00:23:39,000 --> 00:23:41,000

And some later.

440

00:23:42,000 --> 00:23:43,000

One.

441

00:23:43,000 --> 00:23:46,000

They find the ball, maxes out 30 feet along the barrel

442

00:23:46,000 --> 00:23:48,000

at an astonishing velocity.

443

00:23:48,000 --> 00:23:50,000

829.

444

00:23:50,000 --> 00:23:53,000

We're well past Mach 100.

445

00:23:55,000 --> 00:23:58,000

So a quick reset at the requisite length.

446

00:23:58,000 --> 00:24:00,000

Boy, was that tough.

447

00:24:00,000 --> 00:24:02,000

And the guys are expecting...

448

00:24:02,000 --> 00:24:03,000

Let's do it.

449

00:24:03,000 --> 00:24:05,000

The ball to bust out of the packing tape

450

00:24:05,000 --> 00:24:08,000

at over 800 miles per hour.

451

00:24:08,000 --> 00:24:09,000

What?

452

00:24:09,000 --> 00:24:12,000

That would be a supersonic ping-pong ball.

453

00:24:12,000 --> 00:24:15,000

Sounded fast, but who knows what that means.

454

00:24:15,000 --> 00:24:17,000

What it means is...

455

00:24:17,000 --> 00:24:19,000

275 miles per hour.

456

00:24:19,000 --> 00:24:21,000

We're getting less out of a 30-foot barrel

457

00:24:21,000 --> 00:24:23,000

than I was out of a 6-foot barrel.

458

00:24:23,000 --> 00:24:24,000

Yeah.

459

00:24:24,000 --> 00:24:26,000

A frustrating miscalculation.

460

00:24:27,000 --> 00:24:28,000

What the f***?

461

00:24:28,000 --> 00:24:32,000

It's only coming out of the barrel at 192 miles per hour.

462

00:24:32,000 --> 00:24:35,000

The shorter barrel means the ball is now accelerating enough

463

00:24:35,000 --> 00:24:37,000

that it can burst free.

464

00:24:37,000 --> 00:24:40,000

But the air cushion is still an issue.

465

00:24:41,000 --> 00:24:45,000

Even though we're seeing speeds upward of 800 miles per hour

466

00:24:45,000 --> 00:24:49,000

inside the tube, by the time the ball leaves the end of the tube,

467

00:24:49,000 --> 00:24:53,000

it's been decelerated to well under 200 miles an hour.

468

00:24:53,000 --> 00:24:55,000

And that's not lethal.

469

00:24:55,000 --> 00:24:58,000

Yep, so far this myth is misfiring.

470

00:24:59,000 --> 00:25:01,000

Failure is apparently the only option.

471

00:25:03,000 --> 00:25:06,000

Back at Big Boom HQ...

472

00:25:06,000 --> 00:25:08,000

Look at that people!

473

00:25:08,000 --> 00:25:10,000

We have an ice cannon! Ice cannon!

474

00:25:10,000 --> 00:25:11,000

Ice cannon!

475

00:25:11,000 --> 00:25:14,000

It's time to get down to business.

476

00:25:14,000 --> 00:25:15,000

Cannon goes here.

477

00:25:15,000 --> 00:25:19,000

We've come back to Angel's Camp to do the final experiment in our ice cannon myth.

478

00:25:19,000 --> 00:25:20,000

100 feet.

479

00:25:20,000 --> 00:25:23,000

Now, so far it's been very surprising.

480

00:25:23,000 --> 00:25:26,000

We learned that ice cannon balls actually stay intact

481

00:25:26,000 --> 00:25:27,000

and can go the distance.

482

00:25:27,000 --> 00:25:29,000

Right here, 150 feet.

483

00:25:29,000 --> 00:25:31,000

Let's set up our target.

484

00:25:31,000 --> 00:25:33,000

Now, we're going to find out if an ice cannon...

485

00:25:33,000 --> 00:25:35,000

Time to deploy the army...

486

00:25:35,000 --> 00:25:37,000

Can shoot an ice cannon ball.

487

00:25:37,000 --> 00:25:39,000

It's time to go to war.

488

00:25:39,000 --> 00:25:42,000

So this sets up the criteria for our myth.

489

00:25:42,000 --> 00:25:46,000

Number one, the ice cannon has to have sufficient range,

490

00:25:46,000 --> 00:25:49,000

meaning that it has to fire about 150 yards.

491

00:25:49,000 --> 00:25:52,000

Number two, it has to cause significant damage.

492

00:25:53,000 --> 00:25:54,000

This is a family show.

493

00:25:54,000 --> 00:25:56,000

This isn't quite from a family store.

494

00:25:56,000 --> 00:25:58,000

I might have to do a little bit of...

495

00:25:58,000 --> 00:25:59,000

Sensoring.

496

00:25:59,000 --> 00:26:02,000

And number three, it has to be reusable.

497

00:26:02,000 --> 00:26:04,000

One time only doesn't work.

498

00:26:04,000 --> 00:26:05,000

That's better.

499

00:26:05,000 --> 00:26:08,000

If the ice cannon meets all three of these criteria,

500

00:26:08,000 --> 00:26:10,000

then we can call the Smith plausible.

501

00:26:10,000 --> 00:26:12,000

What is that they're wheeling out?

502

00:26:12,000 --> 00:26:14,000

Ha ha ha!

503

00:26:14,000 --> 00:26:15,000

Ugh!

504

00:26:15,000 --> 00:26:19,000

What they're wheeling out is a full-size cannon

505

00:26:19,000 --> 00:26:22,000

with a five-foot long, 20-inch diameter barrel.

506

00:26:22,000 --> 00:26:25,000

It's a very large, big, and long barrel.

507

00:26:25,000 --> 00:26:28,000

It's a fantastic feat of frozen engineering.

508

00:26:29,000 --> 00:26:33,000

The extreme mass coupled with the lack of structural integrity...

509

00:26:33,000 --> 00:26:36,000

What the hell are we doing?

510

00:26:36,000 --> 00:26:39,000

...is an obvious downfall of the building material.

511

00:26:39,000 --> 00:26:41,000

Woo!

512

00:26:41,000 --> 00:26:43,000

But once in position and prep...

513

00:26:43,000 --> 00:26:44,000

Beautiful.

514

00:26:44,000 --> 00:26:45,000

Electric match here.

515

00:26:45,000 --> 00:26:48,000

It truly is a sight to behold.

516

00:26:48,000 --> 00:26:50,000

Oh, it's beautiful.

517

00:26:50,000 --> 00:26:52,000

It's an ice cannon.

518

00:26:52,000 --> 00:26:54,000

And whether it works or not...

519

00:26:54,000 --> 00:26:56,000

Look at that beauty.

520

00:26:56,000 --> 00:26:58,000

I don't stand in front.

521

00:26:58,000 --> 00:27:01,000

The backs to the wall ingenuity is to be celebrated.

522

00:27:01,000 --> 00:27:03,000

All right, we're wired and hot.

523

00:27:03,000 --> 00:27:05,000

What this really is about is innovation.

524

00:27:05,000 --> 00:27:07,000

Improvise weaponry.

525

00:27:07,000 --> 00:27:10,000

Taking what you have to make something completely dangerous

526

00:27:10,000 --> 00:27:12,000

and totally cool.

527

00:27:13,000 --> 00:27:14,000

Or maybe a little dangerous.

528

00:27:14,000 --> 00:27:15,000

We'll see.

529

00:27:16,000 --> 00:27:20,000

Remember, do not try anything you are about to see at home.

530

00:27:23,000 --> 00:27:24,000

Oh.

531

00:27:29,000 --> 00:27:33,000

In our quest to make the innocent 2.7 gram ping pong ball lethal...

532

00:27:34,000 --> 00:27:37,000

I came across a technique online using a vacuum chamber.

533

00:27:37,000 --> 00:27:38,000

Here we go.

534

00:27:39,000 --> 00:27:43,000

That got us amazing speeds on this bench of 375 miles per hour.

535

00:27:43,000 --> 00:27:44,000

Holy s***.

536

00:27:44,000 --> 00:27:47,000

So we thought, let's just add some more barrel.

537

00:27:47,000 --> 00:27:48,000

One.

538

00:27:49,000 --> 00:27:50,000

That's not good.

539

00:27:50,000 --> 00:27:53,000

So far, that has yielded pretty much vopkis for us.

540

00:27:53,000 --> 00:27:54,000

What the f***?

541

00:27:54,000 --> 00:27:55,000

Nothing's making any sense.

542

00:27:55,000 --> 00:27:58,000

But I have, in researching this technique further online,

543

00:27:58,000 --> 00:28:02,000

come across a modification to it that might just give us what we're looking for

544

00:28:02,000 --> 00:28:03,000

and I'm about to build it.

545

00:28:03,000 --> 00:28:05,000

It involves a choke.

546

00:28:05,000 --> 00:28:07,000

With this new piece of tech,

547

00:28:07,000 --> 00:28:11,000

Adam's bringing a little rocket science to the ping pong party.

548

00:28:11,000 --> 00:28:14,000

And to understand what it is and if it works,

549

00:28:14,000 --> 00:28:18,000

Adam's first testing a short barrel prototype.

550

00:28:19,000 --> 00:28:22,000

Part of this rig is very familiar, but the addition of the choke.

551

00:28:22,000 --> 00:28:23,000

Oh.

552

00:28:23,000 --> 00:28:24,000

Kidding.

553

00:28:24,000 --> 00:28:27,000

After I pull a vacuum, I'll put this on here,

554

00:28:27,000 --> 00:28:32,000

thus making this a sealed pressure chamber behind the barrel.

555

00:28:32,000 --> 00:28:33,000

Vacumizing.

556

00:28:34,000 --> 00:28:35,000

When I feel like I've got a full vacuum,

557

00:28:35,000 --> 00:28:38,000

I then hook shop air pressure up into this

558

00:28:38,000 --> 00:28:42,000

and the extra 40 to 60 to 80 psi that comes out of here

559

00:28:42,000 --> 00:28:46,000

will burst this piece of tape sending everything going,

560

00:28:46,000 --> 00:28:48,000

supposedly, much, much faster.

561

00:28:48,000 --> 00:28:50,000

I really hope this works.

562

00:28:50,000 --> 00:28:52,000

Three, two, one.

563

00:28:55,000 --> 00:28:56,000

Oh, oh.

564

00:28:59,000 --> 00:29:00,000

Wow, wow.

565

00:29:00,000 --> 00:29:03,000

The blast of pressurized air popped the vacuum

566

00:29:03,000 --> 00:29:06,000

and added extra energy to the equation.

567

00:29:06,000 --> 00:29:08,000

But just how much?

568

00:29:08,000 --> 00:29:11,000

779 miles per hour.

569

00:29:12,000 --> 00:29:13,000

Momma.

570

00:29:16,000 --> 00:29:18,000

That's what I'm talking about.

571

00:29:18,000 --> 00:29:22,000

What Adam's talking about is that after all their hard work,

572

00:29:22,000 --> 00:29:26,000

they have a ping pong ball faster than the speed of sound.

573

00:29:27,000 --> 00:29:29,000

That's quicker than this.

574

00:29:30,000 --> 00:29:31,000

And this.

575

00:29:32,000 --> 00:29:34,000

So where next from here?

576

00:29:34,000 --> 00:29:37,000

So this is now a working proof concept.

577

00:29:37,000 --> 00:29:40,000

We found out about this technology of adding a choke,

578

00:29:40,000 --> 00:29:42,000

like rocket science.

579

00:29:42,000 --> 00:29:45,000

Rocket science uses a choke to make jets and rockets work

580

00:29:45,000 --> 00:29:47,000

and we put it here with some pressure behind it

581

00:29:47,000 --> 00:29:49,000

and we got 779 miles per hour.

582

00:29:49,000 --> 00:29:53,000

So now we're going to go to a bigger location.

583

00:29:53,000 --> 00:29:55,000

And what a location.

584

00:29:55,000 --> 00:29:57,000

Don't you wish this could be our shop?

585

00:29:57,000 --> 00:29:59,000

Or do I?

586

00:29:59,000 --> 00:30:02,000

Here at fabulous Fort Mason,

587

00:30:02,000 --> 00:30:05,000

Adam and Jamie will definitively answer the question,

588

00:30:05,000 --> 00:30:08,000

how fast can a table tennis ball fly?

589

00:30:09,000 --> 00:30:10,000

One down.

590

00:30:10,000 --> 00:30:12,000

And then test its lethality

591

00:30:12,000 --> 00:30:16,000

by supersizing their prototype ping pong pop gun barrel.

592

00:30:16,000 --> 00:30:18,000

That's the last one.

593

00:30:18,000 --> 00:30:20,000

And the pressurized choke chamber.

594

00:30:20,000 --> 00:30:23,000

Back in the shop, they've used less than 100 psi

595

00:30:23,000 --> 00:30:25,000

to pop the packing tape vacuum.

596

00:30:25,000 --> 00:30:28,000

Now they're ramping it up to 500.

597

00:30:28,000 --> 00:30:30,000

Ready?

598

00:30:30,000 --> 00:30:31,000

Fish?

599

00:30:31,000 --> 00:30:34,000

And they want to deliver that massive blast.

600

00:30:34,000 --> 00:30:36,000

I hope you don't break my arm.

601

00:30:36,000 --> 00:30:37,000

Fast.

602

00:30:42,000 --> 00:30:44,000

I think that was pretty good.

603

00:30:44,000 --> 00:30:46,000

I think that was pretty good.

604

00:30:46,000 --> 00:30:49,000

And with the big beast hooked up and ready for action,

605

00:30:49,000 --> 00:30:51,000

here's how it's going to go down.

606

00:30:51,000 --> 00:30:54,000

The set up out here should be pretty familiar to anyone

607

00:30:54,000 --> 00:30:56,000

who's been watching thus far,

608

00:30:56,000 --> 00:30:58,000

except for the fact that the barrel's 150 feet long.

609

00:30:58,000 --> 00:31:00,000

Behind our vacuum tube, of course, is our pressure chamber

610

00:31:00,000 --> 00:31:03,000

and pressure to 500 pounds per square inch of pressure.

611

00:31:03,000 --> 00:31:05,000

The whole business is activated by this lever,

612

00:31:05,000 --> 00:31:08,000

which we will set off with this.

613

00:31:09,000 --> 00:31:12,000

And so, with the air evacuated from the barrel

614

00:31:12,000 --> 00:31:14,000

and the choke ready to charge,

615

00:31:14,000 --> 00:31:16,000

Jamie steps up to the plate.

616

00:31:16,000 --> 00:31:19,000

Here we go. 500 psi, 150 foot long barrel.

617

00:31:19,000 --> 00:31:22,000

In three, two, one, do it!

618

00:31:26,000 --> 00:31:28,000

It is like a magic trick here.

619

00:31:28,000 --> 00:31:31,000

I was looking at the ping pong ball and then it just wasn't there.

620

00:31:31,000 --> 00:31:32,000

Do it!

621

00:31:32,000 --> 00:31:35,000

It wasn't even like I had a sensation of it moving.

622

00:31:35,000 --> 00:31:38,000

It just whist out of existence.

623

00:31:39,000 --> 00:31:43,000

Which bodes well ballistically until the evidence is found.

624

00:31:45,000 --> 00:31:48,000

There's very little of the ping pong ball left.

625

00:31:49,000 --> 00:31:51,000

And then examined on the high speed.

626

00:31:51,000 --> 00:31:54,000

It's not even left the barrel and it's totally shattered.

627

00:31:54,000 --> 00:31:56,000

That's a bit of a problem.

628

00:31:56,000 --> 00:31:59,000

The problem being they need the full weight of an aerodynamic

629

00:31:59,000 --> 00:32:03,000

intact ball for maximum mortal damage.

630

00:32:03,000 --> 00:32:10,000

The good news is it was going at a speed of 1,086 miles per hour.

631

00:32:14,000 --> 00:32:16,000

That's pretty fast.

632

00:32:16,000 --> 00:32:18,000

That is pretty fast.

633

00:32:20,000 --> 00:32:23,000

Even though our ping pong ball was going at Mach 1.4,

634

00:32:23,000 --> 00:32:25,000

which is amazing,

635

00:32:25,000 --> 00:32:27,000

I can't say that that was successful

636

00:32:27,000 --> 00:32:29,000

because it wasn't a ping pong ball when it left the barrel.

637

00:32:29,000 --> 00:32:32,000

So, we are going to cut this barrel at 20 feet.

638

00:32:32,000 --> 00:32:34,000

We are going to lower the overall pressure.

639

00:32:34,000 --> 00:32:35,000

There we go.

640

00:32:35,000 --> 00:32:38,000

20 foot barrel, 300 psi, semi slow release.

641

00:32:38,000 --> 00:32:40,000

We are not sure what's going to happen.

642

00:32:40,000 --> 00:32:45,000

Three, whatever does ought to really help inform us about what's going on.

643

00:32:45,000 --> 00:32:47,000

Two, so here we go.

644

00:32:47,000 --> 00:32:48,000

One, go!

645

00:32:54,000 --> 00:32:58,000

That was an ever loving smack of a bang.

646

00:32:59,000 --> 00:33:02,000

That was a hell of a bang and that ball is rolling.

647

00:33:04,000 --> 00:33:05,000

The ball is intact.

648

00:33:07,000 --> 00:33:08,000

Wow!

649

00:33:08,000 --> 00:33:10,000

Intact and insane.

650

00:33:10,000 --> 00:33:15,000

Confirmed on the high speed at a world record 1100 miles an hour,

651

00:33:15,000 --> 00:33:22,000

the delicate 2.7 gram ping pong ball is traveling twice as fast as a jumbo jet.

652

00:33:23,000 --> 00:33:26,000

As fast as a speeding bullet.

653

00:33:26,000 --> 00:33:27,000

Now we are talking.

654

00:33:27,000 --> 00:33:32,000

We went from 150 foot barrel to a 20 foot barrel with 300 psi behind it.

655

00:33:32,000 --> 00:33:36,000

Now it's time to find out if the 1100 miles per hour we got out of the end of that barrel,

656

00:33:36,000 --> 00:33:38,000

I think we are ready.

657

00:33:38,000 --> 00:33:40,000

It's in fact lethal.

658

00:33:40,000 --> 00:33:41,000

Lethal balls.

659

00:33:41,000 --> 00:33:43,000

That's what we are looking for.

660

00:33:45,000 --> 00:33:50,000

Adam and Jamie are about to test the lethality of their supersonic balls.

661

00:33:50,000 --> 00:33:53,000

But before that, they want to shoot Jamie's lucky bat.

662

00:33:53,000 --> 00:33:55,000

It has no idea what's in store for it.

663

00:33:55,000 --> 00:33:57,000

Totally knows what's in store for it.

664

00:33:57,000 --> 00:34:00,000

Three, two, one, go!

665

00:34:03,000 --> 00:34:05,000

Holy Batman!

666

00:34:05,000 --> 00:34:06,000

There's your problem.

667

00:34:06,000 --> 00:34:10,000

That is a beautiful, beautiful object.

668

00:34:11,000 --> 00:34:15,000

That is an 1100 mile per hour ping pong ball ladies and gentlemen.

669

00:34:15,000 --> 00:34:17,000

But is it lethal?

670

00:34:24,000 --> 00:34:28,000

In the depths of an 18th century Siberian winter,

671

00:34:30,000 --> 00:34:37,000

a desperate siege-bound army used their imagination and their most abundant resource

672

00:34:39,000 --> 00:34:42,000

and came up with a working ice cannon.

673

00:34:45,000 --> 00:34:51,000

It's been 300 years since this majestic MacGyver-like solution has supposedly worked.

674

00:34:51,000 --> 00:34:54,000

Will it take out the fearsome foam army?

675

00:34:55,000 --> 00:34:57,000

It's the moment of truth.

676

00:34:57,000 --> 00:34:59,000

This is ice cannon final experiment.

677

00:34:59,000 --> 00:35:03,000

In three, two, one.

678

00:35:07,000 --> 00:35:09,000

The cannon is still intact.

679

00:35:09,000 --> 00:35:11,000

So far so good.

680

00:35:11,000 --> 00:35:14,000

With a muzzle velocity of 200 miles an hour,

681

00:35:14,000 --> 00:35:18,000

the cannonball easily covered the 150 yards to the target zone.

682

00:35:19,000 --> 00:35:21,000

Look at this.

683

00:35:21,000 --> 00:35:23,000

This is the ice cannonball.

684

00:35:23,000 --> 00:35:24,000

This is awesome.

685

00:35:24,000 --> 00:35:27,000

We took our first shot and we reached two of the parameters.

686

00:35:27,000 --> 00:35:31,000

One, we made the distance and our cannon is still in good condition.

687

00:35:31,000 --> 00:35:33,000

We can take another shot.

688

00:35:33,000 --> 00:35:35,000

We just didn't get the damage that we were looking for,

689

00:35:35,000 --> 00:35:39,000

but for something that hasn't been done in 300 years, it's pretty good.

690

00:35:39,000 --> 00:35:45,000

Not just pretty good, the team successfully fired a cannon made of water.

691

00:35:45,000 --> 00:35:50,000

But according to their strict criteria, it's not yet successful.

692

00:35:52,000 --> 00:35:54,000

Well, I know the cannonball made it all the way to the guys,

693

00:35:54,000 --> 00:35:56,000

but I'm hoping this time it actually does some damage.

694

00:35:56,000 --> 00:36:00,000

So when you're talking about the damage that a cannonball can cause,

695

00:36:00,000 --> 00:36:02,000

you're talking about kinetic energy.

696

00:36:02,000 --> 00:36:06,000

Kinetic energy depends on two things, mass and velocity.

697

00:36:06,000 --> 00:36:09,000

Now the mass is determined by the ball itself.

698

00:36:09,000 --> 00:36:11,000

So if we want more kinetic energy,

699

00:36:11,000 --> 00:36:14,000

what we need to do is increase the velocity.

700

00:36:14,000 --> 00:36:18,000

Now under normal circumstances, all you need to do is add more black powder

701

00:36:18,000 --> 00:36:20,000

and it comes out faster.

702

00:36:20,000 --> 00:36:22,000

But the more black powder we put in,

703

00:36:22,000 --> 00:36:27,000

the greater risk of destroying the cannon itself before we get a lethal shot.

704

00:36:27,000 --> 00:36:31,000

So with the same amount of black powder, add a tweak trajectory.

705

00:36:31,000 --> 00:36:33,000

We are hot.

706

00:36:33,000 --> 00:36:37,000

Will the ice cold cannon this time be an ice cold killer?

707

00:36:37,000 --> 00:36:42,000

This is the ice cannon in three, two, one.

708

00:36:45,000 --> 00:36:49,000

The answer is no.

709

00:36:49,000 --> 00:36:52,000

Although the ball more than covered the distance,

710

00:36:52,000 --> 00:36:54,000

sailing over the heads of the targets,

711

00:36:54,000 --> 00:36:57,000

this myth is on the rocks.

712

00:36:57,000 --> 00:37:01,000

I like this. I'm going to start crushing my ice this way.

713

00:37:01,000 --> 00:37:06,000

Mixing fire and ice was never likely to be a dangerous cocktail.

714

00:37:06,000 --> 00:37:09,000

But given the severe limitations of the material,

715

00:37:09,000 --> 00:37:12,000

it was an incredible effort of ingenuity.

716

00:37:13,000 --> 00:37:17,000

This is the myth that was almost plausible so many times.

717

00:37:17,000 --> 00:37:19,000

It was looking so good in the beginning.

718

00:37:19,000 --> 00:37:21,000

We started out with our ice cannon balls.

719

00:37:21,000 --> 00:37:24,000

Fired on a real cannon at high speed.

720

00:37:24,000 --> 00:37:27,000

Now we went to the breeches and we found a breech size

721

00:37:27,000 --> 00:37:30,000

that would hold a reasonable amount of black powder.

722

00:37:30,000 --> 00:37:33,000

We put the whole thing together, built a full-size cannon,

723

00:37:33,000 --> 00:37:36,000

brought it out here to face our army.

724

00:37:36,000 --> 00:37:39,000

And it was again looking very promising.

725

00:37:39,000 --> 00:37:43,000

But unfortunately, on the one that would have caused the most damage,

726

00:37:43,000 --> 00:37:47,000

which is the one that sailed over the army's heads and hit the wall,

727

00:37:47,000 --> 00:37:50,000

that's the one where the cannon itself exploded.

728

00:37:50,000 --> 00:37:52,000

And for this myth to be plausible,

729

00:37:52,000 --> 00:37:57,000

we have to have damage and range and reusability all in one.

730

00:37:57,000 --> 00:37:59,000

And that just never happened.

731

00:37:59,000 --> 00:38:03,000

So unfortunately, I think we have to bust this one.

732

00:38:03,000 --> 00:38:06,000

And I'm not happy about it.

733

00:38:09,000 --> 00:38:11,000

You know what?

734

00:38:19,000 --> 00:38:24,000

Table tennis. One of the fastest ball sports on the planet.

735

00:38:24,000 --> 00:38:29,000

But surely, it can never be fast enough to be fatal.

736

00:38:29,000 --> 00:38:31,000

So it all comes down to this.

737

00:38:31,000 --> 00:38:34,000

A ping-pong ball going 1100 miles per hour.

738

00:38:34,000 --> 00:38:36,000

Go.

739

00:38:37,000 --> 00:38:39,000

Versus Flesh.

740

00:38:39,000 --> 00:38:41,000

Which one's gonna win?

741

00:38:41,000 --> 00:38:43,000

We're about to find out.

742

00:38:43,000 --> 00:38:48,000

For our lethality test, today's human analog will be played by a pork shoulder,

743

00:38:48,000 --> 00:38:51,000

otherwise known as a pork butt,

744

00:38:51,000 --> 00:38:55,000

because pork has four shoulders and two of them are butts.

745

00:38:55,000 --> 00:38:57,000

It's true. Look it up.

746

00:38:57,000 --> 00:39:02,000

Question is, will the world record-breaking ball bounce harmlessly off the butt

747

00:39:02,000 --> 00:39:05,000

or penetrate with lethal force?

748

00:39:05,000 --> 00:39:09,000

And it turns some potential energy into some actual energy.

749

00:39:09,000 --> 00:39:10,000

You ready?

750

00:39:10,000 --> 00:39:11,000

I'm ready.

751

00:39:11,000 --> 00:39:12,000

Okay.

752

00:39:12,000 --> 00:39:21,000

Short barrel, 300 psi lethality test with a pork butt in three, two, one, go.

753

00:39:28,000 --> 00:39:30,000

That was a blast.

754

00:39:30,000 --> 00:39:32,000

Literally.

755

00:39:33,000 --> 00:39:35,000

But how did our poor sign pal fare?

756

00:39:35,000 --> 00:39:37,000

All right, let's look at the dent.

757

00:39:37,000 --> 00:39:39,000

Dude.

758

00:39:39,000 --> 00:39:44,000

There's like flesh trauma going down an inch and a half into here.

759

00:39:44,000 --> 00:39:46,000

That's impressive.

760

00:39:46,000 --> 00:39:49,000

I must admit, if you'd asked me beforehand,

761

00:39:49,000 --> 00:39:54,000

I would have told you that I thought the ping-pong ball was going to bounce right off of the pig.

762

00:39:54,000 --> 00:39:59,000

I thought the mass of the two objects were such that the ball really wouldn't do that much damage.

763

00:39:59,000 --> 00:40:02,000

I'm shocked by how much damage it did.

764

00:40:02,000 --> 00:40:05,000

Now that thing actually penetrated.

765

00:40:05,000 --> 00:40:07,000

That's ping-pong ball shaped.

766

00:40:07,000 --> 00:40:09,000

That is a shocker.

767

00:40:09,000 --> 00:40:10,000

That would hurt.

768

00:40:10,000 --> 00:40:14,000

But I think we still need to call that this is a non-lethal hit.

769

00:40:14,000 --> 00:40:18,000

It did not penetrate all the way through the flesh and leave some gaping wound

770

00:40:18,000 --> 00:40:20,000

and barring some lucky hit.

771

00:40:20,000 --> 00:40:22,000

That is not a deadly hit.

772

00:40:22,000 --> 00:40:25,000

This is a substantial flesh wound, but it ain't lethal.

773

00:40:25,000 --> 00:40:32,000

Yep, despite the extreme air pressure and a supersonic ball making the pig fly,

774

00:40:32,000 --> 00:40:35,000

the impact did not mortally harm the ham.

775

00:40:35,000 --> 00:40:42,000

So final verdict, a Mach 1.4 ping-pong ball might just be the fastest ping-pong ball in history.

776

00:40:42,000 --> 00:40:44,000

Extremely dangerous, but not lethal.

777

00:40:44,000 --> 00:40:46,000

Not lethal at all. The myth is busted.

778

00:40:46,000 --> 00:40:47,000

Busted it is.

779

00:40:47,000 --> 00:40:48,000

Let's get out of here.