



1
00:00:02,260 --> 00:00:07,220
[Jet engine revving up]

2
00:00:08,320 --> 00:00:09,220
[Sonic boom]

3
00:00:09,508 --> 00:00:18,584
[Music/Radio chatter]

4
00:00:32,000 --> 00:00:38,800
[Radio chatter]

5
00:00:45,177 --> 00:00:48,013
>> Ok glider RC is up.

6
00:00:48,760 --> 00:00:50,940
>> Good for engine start.

7
00:00:50,940 --> 00:00:52,431
>> Engine start.

8
00:00:53,552 --> 00:01:00,092
[Music]

9
00:01:00,092 --> 00:01:01,160
>> I'm an airplane geek.

10
00:01:01,160 --> 00:01:04,463
I grew up reading
about NACA and NASA

11
00:01:04,463 --> 00:01:07,600
and Edwards Air Force
Base, Rogers Dry Lake.

12
00:01:07,600 --> 00:01:10,703
I think it's beautiful, I
love the arid, dry landscape.

13

00:01:10,703 --> 00:01:13,539

I love the flyable weather
300 plus days a year.

14

00:01:13,539 --> 00:01:14,607

>> How's the tow line look? Come

15

00:01:14,607 --> 00:01:17,009

on back, Derek, I'm having a
hard time seeing it.

16

00:01:17,009 --> 00:01:18,577

>> I have no degree.

17

00:01:18,577 --> 00:01:22,581

I learned my craft from on the
job training and self-education.

18

00:01:22,581 --> 00:01:24,950

My name is Red Jensen
and I'm the Chief Pilot

19

00:01:24,950 --> 00:01:27,419

with the Armstrong Flight
Research Center for small UAS.

20

00:01:27,419 --> 00:01:31,423

I work in the model lab day to
day using sub scale aircraft.

21

00:01:31,423 --> 00:01:33,526

We use those for a variety
of reasons to test things

22

00:01:33,526 --> 00:01:36,662

like new technology which
could be hardware or software,

23

00:01:36,662 --> 00:01:39,532
or even a completely
new vehicle.

24
00:01:39,532 --> 00:01:41,972
>> Coming through, guys

25
00:01:46,071 --> 00:01:49,141
This morning is something you
don't get to see too often.

26
00:01:49,141 --> 00:01:50,876
This is the first flight
of a brand new airplane

27
00:01:50,876 --> 00:01:52,945
so that also means it's
a lot more dangerous

28
00:01:52,945 --> 00:01:54,313
than it normally would be.

29
00:01:54,320 --> 00:01:56,589
Especially for the first
several flights be on your feet,

30
00:01:56,600 --> 00:01:58,268
not sitting down, probably

31
00:01:58,280 --> 00:02:01,350
between the cars is a
great place until we prove

32
00:02:01,360 --> 00:02:04,096
that it's air worthy and
everything is going to go fine.

33
00:02:04,096 --> 00:02:09,619
[Music]

34

00:02:09,619 --> 00:02:12,336

3, 2, 1, release.

35

00:02:12,336 --> 00:02:17,536

[Wind/Music/Background noise]

36

00:02:23,360 --> 00:02:26,196

Heads up guys.

37

00:03:01,280 --> 00:03:03,449

>> Essentially what my job entails
is making sure that the fleet

38

00:03:03,449 --> 00:03:06,576

of subscale aircraft we have
here at Armstrong are capable

39

00:03:06,576 --> 00:03:08,896

of flight, are safe and are
ready to support the center

40

00:03:08,896 --> 00:03:10,949

for the various needs.

41

00:03:10,960 --> 00:03:13,395

>>We're not supposed to
break above 30 knots

42

00:03:13,395 --> 00:03:14,361

for some structural issues.

43

00:03:14,400 --> 00:03:15,635

>> Right.

44

00:03:15,635 --> 00:03:16,835

>> So the trick is to touch
down, roll the throttle...

45

00:03:16,835 --> 00:03:18,501

>> Each one of the
aircraft supports a variety

46

00:03:18,501 --> 00:03:19,715

of different programs.

47

00:03:19,715 --> 00:03:21,749

Any one program at any time
could have a certain set

48

00:03:21,760 --> 00:03:23,461

of milestones they
need to hit and we need

49

00:03:23,461 --> 00:03:24,842

to make sure that can happen.

50

00:03:24,880 --> 00:03:28,116

So we support the buildup, the
integration and the execution

51

00:03:28,116 --> 00:03:30,360

of the actual flights.

52

00:03:30,360 --> 00:03:32,311

[Subscale aircraft taking off]

53

00:03:32,320 --> 00:03:35,223

>> I'm part fabricator,
I'm part engineer,

54

00:03:35,223 --> 00:03:37,436

I'm part integrator
and I'm flight crew.

55

00:03:37,440 --> 00:03:40,509

So I have to manage all of those
elements sort of all in one.

56

00:03:40,509 --> 00:03:43,083

>> We could almost
use that, not quite.

57

00:03:43,120 --> 00:03:45,656

>> Yeah except we're
going to have to angle it.

58

00:03:45,680 --> 00:03:48,616

>> A typical day is you come
in and I usually make a list

59

00:03:48,640 --> 00:03:49,841

of the things that we want

60

00:03:49,841 --> 00:03:51,776

to accomplish during the
week and then also daily.

61

00:03:51,776 --> 00:03:53,728

On non-fly days we
have ongoing projects,

62

00:03:53,760 --> 00:03:55,695

things that need maintenance.

63

00:03:55,695 --> 00:03:57,082

>> Basically case 5.

64

00:03:57,120 --> 00:03:58,388

>> Case 5 yeah.

65

00:03:58,400 --> 00:04:01,203

>> Alright so is that
our max design intent?

66

00:04:01,203 --> 00:04:03,702

Is that what that is now?

67

00:04:03,702 --> 00:04:05,348

>> I work on drawings for layups

68

00:04:05,360 --> 00:04:07,596

and engineering calculations
for load.

69

00:04:07,600 --> 00:04:09,535

We are setting up,
mounting components,

70

00:04:09,535 --> 00:04:11,823

testing them, getting
ready to fly.

71

00:04:13,120 --> 00:04:15,256

>> Often I have to
make a one-off part.

72

00:04:15,280 --> 00:04:17,682

I also have the capability
to 3D print parts in house,

73

00:04:17,682 --> 00:04:20,016

which has been a blessing
because it allows me

74

00:04:20,016 --> 00:04:21,401

to design something
in the morning,

75

00:04:21,440 --> 00:04:23,742

build it in the afternoon and
then install it in the evening,

76

00:04:23,760 --> 00:04:25,929

it's really that quick.

77

00:04:27,920 --> 00:04:36,863

[Music/Background talking]

78

00:04:36,880 --> 00:04:38,715

>> Flight day usually
starts two days before.

79

00:04:38,720 --> 00:04:41,256

I don't like to rush,
I want to make sure

80

00:04:41,280 --> 00:04:44,183

that we don't miss anything
because on a flight day

81

00:04:44,183 --> 00:04:47,930

if you do miss something well
that's just making everybody

82

00:04:47,930 --> 00:04:50,055

wait and that's not cool.

83

00:04:50,080 --> 00:04:52,049

If the system hasn't
flown in a while,

84

00:04:52,080 --> 00:04:54,416

or it's got a new
component in it we do a CST,

85

00:04:54,416 --> 00:04:57,570

which is a combined systems test
where we turn everything on just

86

00:04:57,600 --> 00:04:59,935

like in flight environment,
including starting the engine

87

00:04:59,935 --> 00:05:02,923

if applicable, run it and do
all of these ground tests just

88

00:05:02,960 --> 00:05:05,463

like we were going to go fly and
make sure that everything works

89

00:05:05,463 --> 00:05:06,941

and plays nice together.

90

00:05:06,960 --> 00:05:08,428

That way when we get
out on the lake bed

91

00:05:08,428 --> 00:05:10,870

to fly there's no surprises.

92

00:05:10,880 --> 00:05:12,880

[propeller turning]

93

00:05:13,680 --> 00:05:15,482

[Background talking]

94

00:05:15,520 --> 00:05:17,822

>> So when that's done let's say
on a Monday we finish our CST,

95

00:05:17,840 --> 00:05:21,043

Tuesday is prep and loading
day where we'll maintenance all

96

00:05:21,043 --> 00:05:23,943

of the batteries, make sure
the generator has gas in it,

97

00:05:23,943 --> 00:05:26,089

make all of the arrangements
for frequencies

98

00:05:26,089 --> 00:05:28,089

and whatever else we might

need on the lake bed.

99

00:05:28,089 --> 00:05:30,329

Load up the vehicles and be prepared for the next day.

100

00:05:30,329 --> 00:05:33,369

[Music]

101

00:05:37,200 --> 00:05:39,736

The third day, flight day, usually starts

102

00:05:39,760 --> 00:05:41,028

at 6 am in the model lab.

103

00:05:41,040 --> 00:05:42,841

I like to get there again a little bit early,

104

00:05:42,880 --> 00:05:44,882

go over my checklist, make sure I have everything loaded,

105

00:05:44,882 --> 00:05:46,515

everything is prepped and ready to go.

106

00:05:46,515 --> 00:05:50,117

I typically like to be airborne by 9 for weather reasons

107

00:05:50,117 --> 00:05:51,882

and that gives us the best chance to fly as much

108

00:05:51,920 --> 00:05:53,155

as we need throughout the day.

109

00:05:53,155 --> 00:05:55,389

>> It's airborne.

110

00:05:55,389 --> 00:05:57,262

A little bit of right
aileron trim,

111

00:05:57,280 --> 00:06:01,050

a little up elevator trim,
here comes a flap check,

112

00:06:01,050 --> 00:06:04,010

1 notch, no pitch change,

113

00:06:04,010 --> 00:06:09,080

2 notches, very nice, no
pitch change, flap fall.

114

00:06:09,080 --> 00:06:10,867

[Radio chatter]

115

00:06:10,880 --> 00:06:13,249

>> ...first
stall is clean.

116

00:06:13,280 --> 00:06:14,080

>> 28

117

00:06:14,080 --> 00:06:15,382

>> Keep them coming, Clue

118

00:06:15,382 --> 00:06:17,382

[Radio chatter]

119

00:06:20,320 --> 00:06:22,800

Alright I'm going to start
setting up for an approach.

120

00:06:24,960 --> 00:06:27,063

>> And we're down.

121

00:06:27,063 --> 00:06:36,116

[Music]

122

00:06:38,320 --> 00:06:39,655

>> The largest project
that we're working

123

00:06:39,680 --> 00:06:41,282

on right now is the
T-GALS concept

124

00:06:41,282 --> 00:06:44,083

which is the towed glider
air launch to orbit concept

125

00:06:44,083 --> 00:06:47,950

where we use a glider to
carry a rocket launch vehicle

126

00:06:47,950 --> 00:06:50,089

up to an altitude,
release that rocket

127

00:06:50,089 --> 00:06:51,882

and then it will
head on into space.

128

00:06:51,920 --> 00:06:56,391

The idea is cheaper cost
per pound launches to orbit.

129

00:06:56,400 --> 00:07:00,070

So by air launching the launch
vehicle, we gain somewhere

130

00:07:00,080 --> 00:07:03,550

in the order of 50% performance
increase to get the same amount

131

00:07:03,550 --> 00:07:05,556
of payload into orbit.

132

00:07:05,556 --> 00:07:09,323
We have built and are flying
a quarter scale, roughly, model

133

00:07:09,360 --> 00:07:10,729
that eventually could turn

134

00:07:10,729 --> 00:07:15,124
into a hundred foot wingspan
full scale X plane type program.

135

00:07:15,124 --> 00:07:17,689
Another program that we've been
working on is called PRANDTL.

136

00:07:17,689 --> 00:07:19,749
PRANDTL is looking at a
new way to design a wing

137

00:07:19,760 --> 00:07:21,962
to reduce induced drag.

138

00:07:22,000 --> 00:07:24,503
Induced drag is the
by-product of creating lift.

139

00:07:24,503 --> 00:07:26,448
So when you create
lift you create drag.

140

00:07:26,480 --> 00:07:29,717
This particular wing uses
twist to reduce that drag

141

00:07:29,717 --> 00:07:33,150

at the wing tips and
manipulate that for control.

142

00:07:33,150 --> 00:07:35,622
>> 3, 2, 1, release.

143

00:07:35,622 --> 00:07:38,737
>> It has huge long
range potential benefits.

144

00:07:38,737 --> 00:07:41,690
Things like airliners
where you see the winglet

145

00:07:41,690 --> 00:07:43,648
on every air liner that
increases efficiency.

146

00:07:43,680 --> 00:07:45,348
PRANDTL looks to do
much of the same thing

147

00:07:45,360 --> 00:07:47,362
but even on a bigger scale.

148

00:07:47,362 --> 00:07:49,863
Flight days they can be an
hour, they can be six hours,

149

00:07:49,863 --> 00:07:51,909
just depends on what
we're doing.

150

00:07:51,920 --> 00:07:55,323
We'll bring everything back to
the lab, unload what we need

151

00:07:55,360 --> 00:07:58,063
to unload and then gather any
data that's necessary and send

152

00:07:58,080 --> 00:07:59,581
that out to the proper folks.

153

00:07:59,600 --> 00:08:02,103
I don't do too much
of the data analyzing

154

00:08:02,103 --> 00:08:04,015
but I definitely
facilitate the downloading

155

00:08:04,015 --> 00:08:06,770
and we certainly look at
the data but that's left

156

00:08:06,800 --> 00:08:09,636
to other folks on their
respective projects

157

00:08:09,636 --> 00:08:10,968
to analyze the data.

158

00:08:10,968 --> 00:08:14,263
My job is to gather the data,
make sure the data is good,

159

00:08:14,263 --> 00:08:17,243
and then disseminate it.

160

00:08:17,280 --> 00:08:19,182
I love to design.

161

00:08:19,200 --> 00:08:20,935
I design a lot of
my own aircraft

162

00:08:20,960 --> 00:08:23,930
and you just simply can't do

that easily in a manned world.

163

00:08:23,930 --> 00:08:26,722

Timeline, cost, risk, all of those things play a factor.

164

00:08:26,722 --> 00:08:29,790

With subscale aircraft you can do almost anything you want

165

00:08:29,790 --> 00:08:32,696

without much risk and you can realize those gains

166

00:08:32,720 --> 00:08:33,822

very quickly.

167

00:08:33,840 --> 00:08:37,680

[Subscale aircraft taking off]

168

00:08:37,680 --> 00:08:39,676

>> Being that we're not putting out a product,

169

00:08:39,680 --> 00:08:42,416

we don't have a product at the end of the day that we have

170

00:08:42,416 --> 00:08:45,570

to sell; that gives us a lot more latitude to research things

171

00:08:45,600 --> 00:08:49,570

that maybe a for profit company wouldn't bother to research.

172

00:08:49,600 --> 00:08:50,968

[aircraft flying]

173

00:08:50,968 --> 00:08:52,395

>> You know, the winglet
may not have come

174

00:08:52,400 --> 00:08:54,168

around if it hadn't
have been for NASA.

175

00:08:54,168 --> 00:08:56,663

Some guy looking for a few
percent advantage looked

176

00:08:56,663 --> 00:08:59,610

into it and figured it out.

177

00:08:59,610 --> 00:09:01,802

Dale Reed was a pioneer
of using subscale aircraft

178

00:09:01,840 --> 00:09:04,609

and he was sort looked as sort
of a crack pot around here.

179

00:09:04,640 --> 00:09:08,077

He got the idea of a cone shape
as a re-entry type vehicle,

180

00:09:08,080 --> 00:09:09,715

cut it in half into
the half cone

181

00:09:09,715 --> 00:09:12,283

with is the classic lifting
body shape that we know now

182

00:09:12,320 --> 00:09:15,890

and those early trials led
directly to the space shuttle.

183

00:09:15,920 --> 00:09:18,456

So we look into sometimes
the minutiae of how

184

00:09:18,480 --> 00:09:21,549
and why things work that
doesn't necessarily make sense

185

00:09:21,549 --> 00:09:23,289
for a for profit company.

186

00:09:23,289 --> 00:09:25,115
Everything that we do
benefits the public,

187

00:09:25,120 --> 00:09:27,489
nothing is held back,
everything is published

188

00:09:27,520 --> 00:09:30,556
and available for anyone to use.

189

00:09:30,560 --> 00:09:33,930
NASA is a fantastic
environment to work in.

190

00:09:33,930 --> 00:09:37,090
It's just being part of an
R & D environment and part

191

00:09:37,120 --> 00:09:40,090
of something that maybe someday
somebody else might remember

192

00:09:40,090 --> 00:09:42,182
that was something cool
and I can say "oh," you know

193

00:09:42,182 --> 00:09:43,862
to my grandkids, "oh
yeah I worked on that"

194

00:09:43,862 --> 00:09:45,702

that would be pretty cool.

195

00:09:45,702 --> 00:09:48,560

I would probably be unhappy
sitting behind a desk somewhere

196

00:09:48,560 --> 00:09:50,560

if I wasn't flying airplanes.

197

00:09:50,560 --> 00:09:55,280

[Music/Wind]

198

00:09:55,280 --> 00:09:58,200

[Glider scraping along ground]