



Ames Research Center



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Center



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Research Center

Research

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s Rese



1
00:00:01,033 --> 00:00:07,033
[music playing]

2
00:00:17,433 --> 00:00:19,300
- Hello, everyone,
and welcome

3
00:00:19,300 --> 00:00:22,133
to the Director's Colloquium
Summer Series

4
00:00:22,133 --> 00:00:25,000
presented by the Office
of the Chief Scientist

5
00:00:25,000 --> 00:00:27,366
here at NASA Ames
Research Center.

6
00:00:27,366 --> 00:00:29,833
This is the ninth in the series
for the summer.

7
00:00:29,833 --> 00:00:33,466
Today, we are exploring
the National Advisory Committee

8
00:00:33,466 --> 00:00:37,866
for Aeronautics, the NACA,
the predecessor agency to NASA.

9
00:00:37,866 --> 00:00:41,133
The NACA is the DNA of NASA.

10
00:00:41,133 --> 00:00:44,600
This year, NASA is celebrating
the centenary of the NACA.

11
00:00:44,600 --> 00:00:49,033

100 years ago, March 3, 1915,
on the eve of World War I,

12

00:00:49,033 --> 00:00:52,566
Congress established the NACA
to reassert American leadership

13

00:00:52,566 --> 00:00:53,900
in aeronautics.

14

00:00:53,900 --> 00:00:57,633
Over the ensuing four decades,
NACA research drove

15

00:00:57,633 --> 00:01:00,966
the growth of American aviation
and then laid the foundation

16

00:01:00,966 --> 00:01:03,033
for America's leap into space.

17

00:01:03,033 --> 00:01:06,266
In 1958, the four NACA
laboratories--

18

00:01:06,266 --> 00:01:09,200
Ames, Lewis, Langley,
and the research station

19

00:01:09,200 --> 00:01:10,733
in the California high desert--

20

00:01:10,733 --> 00:01:12,566
formed the nucleus of NASA.

21

00:01:12,566 --> 00:01:15,366
In addition, NACA people
spread out to form

22

00:01:15,366 --> 00:01:18,266
the core technical staff
of the four new NASA centers

23
00:01:18,266 --> 00:01:20,566
in Florida, Texas, and Maryland.

24
00:01:20,566 --> 00:01:23,300
Today, the NACA heritage
within NASA remains strong.

25
00:01:23,300 --> 00:01:25,100
That is especially true
in the first "A"

26
00:01:25,100 --> 00:01:27,900
in NASA aeronautics research,
where NASA continues

27
00:01:27,900 --> 00:01:30,400
to look years ahead
and develop new technologies

28
00:01:30,400 --> 00:01:32,366
to support the entire
aviation industry,

29
00:01:32,366 --> 00:01:34,133
as in green aircraft
technologies

30
00:01:34,133 --> 00:01:37,100
and more efficient means
of air traffic control.

31
00:01:37,100 --> 00:01:40,533
In discussions of space policy,
the early NACA support

32
00:01:40,533 --> 00:01:43,600

of commercial aviation has been
seen as an analogy

33

00:01:43,600 --> 00:01:47,166
to how the government
can support commercial space

34

00:01:47,166 --> 00:01:48,933
activities moving forward.

35

00:01:48,933 --> 00:01:50,733
Still, even though the NACA
was considered

36

00:01:50,733 --> 00:01:52,800
a remarkably effective
government agency,

37

00:01:52,800 --> 00:01:55,933
there is much debate
over what made it so successful.

38

00:01:55,933 --> 00:01:58,033
Today, we are delighted
to have three legends

39

00:01:58,033 --> 00:02:01,533
talk with us about
their experience with the NACA

40

00:02:01,533 --> 00:02:04,500
and about the enduring
importance of the NACA.

41

00:02:04,500 --> 00:02:07,033
At the far end,
we have Walter Vincenti.

42

00:02:07,033 --> 00:02:08,566
Even though Walter lived

three blocks

43

00:02:08,566 --> 00:02:11,433
from the Caltech campus,
he decided to go to Stanford

44

00:02:11,433 --> 00:02:12,766
and earned
his bachelor's degree

45

00:02:12,766 --> 00:02:15,033
in mechanical engineering
in 1938,

46

00:02:15,033 --> 00:02:17,333
and then his
engineer's degree in 1940.

47

00:02:17,333 --> 00:02:19,466
If you're doing the math
in your head,

48

00:02:19,466 --> 00:02:21,600
he just turned 98 in April.

49

00:02:21,600 --> 00:02:24,600
[applause]

50

00:02:28,366 --> 00:02:31,333
On June 1, 1940,
just over 75 years ago,

51

00:02:31,333 --> 00:02:33,333
Walter joined
the Ames Aeronautical Laboratory

52

00:02:33,333 --> 00:02:35,000
as the fourth engineer on staff

53

00:02:35,000 --> 00:02:38,366
after Jack Parson, Harvey Allen,
and Carlton Bioletti.

54

00:02:38,366 --> 00:02:39,966
He started by building
wind tunnels

55

00:02:39,966 --> 00:02:42,333
and gained a sterling reputation
in expansion joints

56

00:02:42,333 --> 00:02:44,133
and reinforced concrete.

57

00:02:44,133 --> 00:02:46,533
In the decade after the war,
Walter did pioneering

58

00:02:46,533 --> 00:02:49,433
theoretical and experimental
work in high-speed aerodynamics,

59

00:02:49,433 --> 00:02:51,466
pushing flight
from the supersonic realm

60

00:02:51,466 --> 00:02:53,100
into the hypersonic.

61

00:02:53,100 --> 00:02:55,400
In 1957, in the aftermath
of Sputnik

62

00:02:55,400 --> 00:02:58,266
and new government funding
for education,

63

00:02:58,266 --> 00:03:00,733
he was recruited by Stanford

to teach in their

64

00:03:00,733 --> 00:03:02,966

newly invigorated

Department of Aeronautics

65

00:03:02,966 --> 00:03:04,200

and Astronautics.

66

00:03:04,200 --> 00:03:07,166

In 1971, he co-founded

Stanford's program

67

00:03:07,166 --> 00:03:08,933

in science technology

and society,

68

00:03:08,933 --> 00:03:11,366

and enjoyed a second career

as a leading historian

69

00:03:11,366 --> 00:03:12,666

of technology.

70

00:03:12,666 --> 00:03:14,533

His award-winning book

of case studies,

71

00:03:14,533 --> 00:03:16,433

titled "What Engineers Know

and How They Know It,"

72

00:03:16,433 --> 00:03:18,833

is really required reading

for anybody who wants to know

73

00:03:18,833 --> 00:03:20,833

about the history of the NACA

74

00:03:20,833 --> 00:03:23,366
and about engineering
epistemology.

75

00:03:23,366 --> 00:03:25,966
In 1947, when Walter served
as branch chief

76

00:03:25,966 --> 00:03:28,033
in the 1x3 foot
supersonic tunnel,

77

00:03:28,033 --> 00:03:30,133
he was Jack Boyd's first boss.

78

00:03:30,133 --> 00:03:32,566
That's Jack Boyd sitting
in the center there.

79

00:03:32,566 --> 00:03:35,966
Jack reported to work
on January 15, 1947,

80

00:03:35,966 --> 00:03:39,400
joining Harvey Allen's famed
high-speed aeronautics division,

81

00:03:39,400 --> 00:03:42,266
which included R.T. Jones,
Al Eggers, Dean Chapman,

82

00:03:42,266 --> 00:03:44,066
and Walter Vincenti.

83

00:03:44,066 --> 00:03:46,866
In 1963, Allen,
then associate director,

84

00:03:46,866 --> 00:03:49,333
asked Jack to be

his technical assistant

85

00:03:49,333 --> 00:03:52,000
and marshal all of Ames' work
into a coherent

86

00:03:52,000 --> 00:03:55,466
research program to support
the booming Apollo program.

87

00:03:55,466 --> 00:03:57,533
Jack then rose through
the managerial ranks at Ames,

88

00:03:57,533 --> 00:03:59,433
which included stints
as Associate Administrator

89

00:03:59,433 --> 00:04:01,466
for Management
at NASA headquarters

90

00:04:01,466 --> 00:04:03,700
and Deputy Director
for Dryden Research Center,

91

00:04:03,700 --> 00:04:05,200
now Armstrong.

92

00:04:05,200 --> 00:04:08,066
Today, still hard at work,
Jack serves as Senior Advisor

93

00:04:08,066 --> 00:04:09,866
to the Center Director,
Omsbud,

94

00:04:09,866 --> 00:04:11,733
and Senior Advisor for History.

95

00:04:11,733 --> 00:04:15,000

In 1956, while Jack served
as branch chief

96

00:04:15,000 --> 00:04:17,033

in the 6x6 foot
supersonic tunnel,

97

00:04:17,033 --> 00:04:19,533

he was Vic Peterson's
first boss.

98

00:04:19,533 --> 00:04:21,900

That's Vic sitting over there
on the right.

99

00:04:21,900 --> 00:04:24,066

After graduating
from Oregon State University,

100

00:04:24,066 --> 00:04:26,333

Vic Peterson joined Ames
in 1956

101

00:04:26,333 --> 00:04:28,066

as an aeronautical engineer

102

00:04:28,066 --> 00:04:30,100

focused on supersonic
aerodynamics,

103

00:04:30,100 --> 00:04:32,400

and soon moved into research
on vehicles

104

00:04:32,400 --> 00:04:34,800

entering atmospheres
other than Earth.

105

00:04:34,800 --> 00:04:37,433

In 1968, he got his first management assignment.

106

00:04:37,433 --> 00:04:40,466

By 1974, he became Chief of the Thermo and Gas

107

00:04:40,466 --> 00:04:43,133

Dynamics Division, responsible for the center

108

00:04:43,133 --> 00:04:45,566

suite of research in high-speed wind tunnels,

109

00:04:45,566 --> 00:04:48,500

arc jets, ballistic ranges, and supercomputers.

110

00:04:48,500 --> 00:04:51,433

In 1990, he was appointed Deputy Director at Ames,

111

00:04:51,433 --> 00:04:54,466

where he served until retiring in 1994.

112

00:04:54,466 --> 00:04:56,833

He was an early advocate for the Numeric Aerodynamic

113

00:04:56,833 --> 00:04:58,933

Simulation facility, the NAS.

114

00:04:58,933 --> 00:05:02,666

And in his post-Ames years, he served on numerous boards

115

00:05:02,666 --> 00:05:05,600
and study groups related
to our nation's

116
00:05:05,600 --> 00:05:07,433
supercomputing capabilities.

117
00:05:07,433 --> 00:05:09,333
So here's how the panel
will proceed.

118
00:05:09,333 --> 00:05:10,766
Jack will give a short
presentation

119
00:05:10,766 --> 00:05:12,733
on the history and
accomplishments of the NACA

120
00:05:12,733 --> 00:05:14,500
to give you some background.

121
00:05:14,500 --> 00:05:16,766
Then Walt and Vic will give
some opening comments,

122
00:05:16,766 --> 00:05:19,233
and we will open the floor
for questions.

123
00:05:19,233 --> 00:05:22,166
But first, our friends
at Glenn Research Center,

124
00:05:22,166 --> 00:05:25,666
previously named
the Lewis Research Center

125
00:05:25,666 --> 00:05:28,833
after the first research

director of the NACA,

126

00:05:28,833 --> 00:05:31,733

sent us a video statement
on the importance of the NACA

127

00:05:31,733 --> 00:05:33,966

from someone who would know.

128

00:05:33,966 --> 00:05:37,366

Simon Ostrach joined the NACA
Aircraft Engine

129

00:05:37,366 --> 00:05:40,300

Research Laboratory
in Cleveland in 1944.

130

00:05:40,300 --> 00:05:43,733

In 1960, he moved to the
Case Institute of Technology

131

00:05:43,733 --> 00:05:47,033

to lead its work in heat
transfer and fluid physics

132

00:05:47,033 --> 00:05:49,833

to support a variety
of NASA missions.

133

00:05:49,833 --> 00:05:52,166

So let's see the video.

134

00:05:52,166 --> 00:05:54,833

- I'm Simon Ostrach,
and I came to

135

00:05:54,833 --> 00:05:58,566

the Aircraft Engine
Research Laboratory

136

00:05:58,566 --> 00:06:04,100
of NACA in Cleveland
in June of 1944.

137

00:06:04,100 --> 00:06:06,266
The problems we confronted then

138

00:06:06,266 --> 00:06:10,866
were problems
due to the war effort,

139

00:06:10,866 --> 00:06:14,100
specifically engine problems

140

00:06:14,100 --> 00:06:17,700
for various aircraft.

141

00:06:17,700 --> 00:06:21,066
We attacked those problems
in the usual sort of

142

00:06:21,066 --> 00:06:24,466
semiempirical ways.

143

00:06:24,466 --> 00:06:28,400
After the war,
we started to do research

144

00:06:28,400 --> 00:06:31,100
on the next type
of propulsion system,

145

00:06:31,100 --> 00:06:34,066
whether it be a turbo jet
or a turbo prop.

146

00:06:34,066 --> 00:06:36,733
And about this time,
my branch chief

147

00:06:36,733 --> 00:06:39,466
had suggested that I go
to graduate school

148

00:06:39,466 --> 00:06:41,300
and get a PhD.

149

00:06:41,300 --> 00:06:43,466
That thought had never
entered my mind,

150

00:06:43,466 --> 00:06:46,200
but I did follow up
with that.

151

00:06:46,200 --> 00:06:49,966
And from 1947 to 1950,

152

00:06:49,966 --> 00:06:52,033
I went to graduate school

153

00:06:52,033 --> 00:06:54,033
and got a PhD
in applied mathematics

154

00:06:54,033 --> 00:06:55,933
at Brown University.

155

00:06:55,933 --> 00:06:58,866
When I came back,
there was just a flurry

156

00:06:58,866 --> 00:07:02,600
of real research being done

157

00:07:02,600 --> 00:07:04,733
by very smart people.

158

00:07:04,733 --> 00:07:07,633

And the environment could not
have been better

159

00:07:07,633 --> 00:07:12,400

any place for a postdoc.

160

00:07:12,400 --> 00:07:13,733

Then, when the space--

161

00:07:13,733 --> 00:07:17,666

When NAC--NASA was established,

162

00:07:17,666 --> 00:07:19,900

there started to be

163

00:07:19,900 --> 00:07:21,800

a big cultural change,

164

00:07:21,800 --> 00:07:24,566

and that the problems
of the space--

165

00:07:24,566 --> 00:07:28,366

of the space program
were very different

166

00:07:28,366 --> 00:07:31,833

from the problems
that we had confronted at NACA.

167

00:07:31,833 --> 00:07:36,266

And so the personnel started

168

00:07:36,266 --> 00:07:37,733

turning more to being

169

00:07:37,733 --> 00:07:40,666

program managers
than research people.

170
00:07:40,666 --> 00:07:42,433
And a lot of the good
research people

171
00:07:42,433 --> 00:07:45,666
started to leave
for industry and academe.

172
00:07:45,666 --> 00:07:48,466
And I left in 1960

173
00:07:48,466 --> 00:07:50,966
to become a professor

174
00:07:50,966 --> 00:07:53,466
at Case Western Reserve
University,

175
00:07:53,466 --> 00:07:57,666
where I was for 45 years.

176
00:07:57,666 --> 00:08:03,166
NASA is quite a very different
organization than NACA was

177
00:08:03,166 --> 00:08:07,900
in that most of the people
are program managers.

178
00:08:07,900 --> 00:08:12,000
And at least at what is now

179
00:08:12,000 --> 00:08:14,800
the Glenn Research Center,

180
00:08:14,800 --> 00:08:18,466

research is not
the number one priority.

181
00:08:18,466 --> 00:08:22,766
And that, I think,
is the major difference.

182
00:08:22,766 --> 00:08:24,533
- Thank you to Si
for those comments.

183
00:08:24,533 --> 00:08:27,366
And now, Jack,
would you like to?

184
00:08:27,366 --> 00:08:28,800
- You want me up there,
I assume?

185
00:08:28,800 --> 00:08:30,866
- Yes.

186
00:08:30,866 --> 00:08:33,700
- Okay.

187
00:08:33,700 --> 00:08:37,833
First, I got to get up there.

188
00:08:37,833 --> 00:08:40,166
Okay.
Thanks, Glenn.

189
00:08:40,166 --> 00:08:43,266
Before I talk a little bit
about NACA

190
00:08:43,266 --> 00:08:44,966
and some of the things we did,

191

00:08:44,966 --> 00:08:49,166

I'd like to make two
out-of-the-box comments.

192

00:08:49,166 --> 00:08:53,100

Some of the people who talked
about NACA from the old days,

193

00:08:53,100 --> 00:08:55,900

one of them was a guy
named Abe Silverstein.

194

00:08:55,900 --> 00:08:58,300

Can you hear me?
You guys hear?

195

00:08:58,300 --> 00:09:02,366

And he was a director at Lewis,
which is now Glenn.

196

00:09:02,366 --> 00:09:06,900

He said,
"NACA has one big problem."

197

00:09:06,900 --> 00:09:11,333

He said,
"Langley gets all the money.

198

00:09:11,333 --> 00:09:15,233

Lewis gets all the people.

199

00:09:15,233 --> 00:09:17,633

And Ames gets all the brains."

200

00:09:17,633 --> 00:09:20,966

And it's been that way
ever since, okay?

201

00:09:20,966 --> 00:09:24,600

And the other point was

that if you worked--

202

00:09:24,600 --> 00:09:29,866

The reason NACA worked so well,
they say--this guy says,

203

00:09:29,866 --> 00:09:33,400

is that it has a committee.

204

00:09:33,400 --> 00:09:35,933

It was run by a committee
of about 12 people.

205

00:09:35,933 --> 00:09:38,866

Which means once a year,
it gives out money,

206

00:09:38,866 --> 00:09:40,900

and then goes away
and leaves you alone.

207

00:09:40,900 --> 00:09:42,466

Would it be that way this time?

208

00:09:42,466 --> 00:09:43,800

I don't know.
I doubt it.

209

00:09:43,800 --> 00:09:46,000

But anyway, that's the way
we'll start out.

210

00:09:46,000 --> 00:09:47,433

Let's go to the first chart.

211

00:09:53,400 --> 00:09:56,166

This--there are a few word
charts here, you can--

212

00:09:56,166 --> 00:09:57,700

I'll give you time
to read them.

213

00:09:57,700 --> 00:10:01,266

But this just tells you how
NACA was really established

214

00:10:01,266 --> 00:10:04,100

in March 3, 1915,

215

00:10:04,100 --> 00:10:06,300

so 100 years ago in March.

216

00:10:06,300 --> 00:10:10,500

And it was established simply
to do aeronautical research.

217

00:10:10,500 --> 00:10:12,733

When you think about it,
the Wright Brothers

218

00:10:12,733 --> 00:10:14,700

flew in 1903.

219

00:10:14,700 --> 00:10:18,066

And not before 1903, actually,

220

00:10:18,066 --> 00:10:20,733

there was a lot of things
going on around the world

221

00:10:20,733 --> 00:10:22,833

in developing aircraft.

222

00:10:22,833 --> 00:10:25,500

After 1903,
we didn't do very much,

223

00:10:25,500 --> 00:10:26,700
this country.

224

00:10:26,700 --> 00:10:29,366
There was a lot going on
overseas still.

225

00:10:29,366 --> 00:10:31,433
And I think somebody
got word about it

226

00:10:31,433 --> 00:10:34,133
and said you need some
focused area

227

00:10:34,133 --> 00:10:36,933
to do research on aircraft

228

00:10:36,933 --> 00:10:39,133
so we can catch up
with the other people.

229

00:10:39,133 --> 00:10:42,766
And so they decided to set up
this NACA committee.

230

00:10:42,766 --> 00:10:46,900
And it was devoted to looking
at problems very simply,

231

00:10:46,900 --> 00:10:48,866
the problems of aircraft
with a focus

232

00:10:48,866 --> 00:10:50,300
on how to solve them.

233

00:10:50,300 --> 00:10:52,800
And that was a simple
question that was posed.

234

00:10:52,800 --> 00:10:54,700

And the next chart gives you
a little more detail

235

00:10:54,700 --> 00:10:56,000

on how that--

236

00:10:56,000 --> 00:10:58,800

Next chart.

237

00:10:58,800 --> 00:11:02,300

That's a simple statement
of the charter of NACA.

238

00:11:02,300 --> 00:11:05,466

And it was done deliberately.

239

00:11:05,466 --> 00:11:07,966

It was Langley coming along
in 1917

240

00:11:07,966 --> 00:11:10,133

to do aeronautical research.

241

00:11:10,133 --> 00:11:12,466

It was many years later,
actually, quite a lot,

242

00:11:12,466 --> 00:11:17,266

before we decided to have
a second laboratory, Ames.

243

00:11:17,266 --> 00:11:21,266

And this second laboratory
was set up

244

00:11:21,266 --> 00:11:25,100

because Charles Lindbergh

was really concerned

245

00:11:25,100 --> 00:11:27,300
about what they were doing
in Europe.

246

00:11:27,300 --> 00:11:29,333
And he came back and told
the president this.

247

00:11:29,333 --> 00:11:32,700
And the president said,
"Well, if you think

248

00:11:32,700 --> 00:11:34,766
we should have a second lab,
where?"

249

00:11:34,766 --> 00:11:36,966
And he gave him the job
of finding out.

250

00:11:36,966 --> 00:11:38,533
And Lindbergh went around
the country

251

00:11:38,533 --> 00:11:42,033
and found this semi-empty
naval base.

252

00:11:42,033 --> 00:11:45,233
It wasn't totally empty,
but there was 2,000 acres here.

253

00:11:45,233 --> 00:11:48,466
And only about 500 were
being used by the Navy.

254

00:11:48,466 --> 00:11:52,066
And the Navy had the large

hangar that you see over there.

255

00:11:52,066 --> 00:11:55,600

And the "Macon" dirigible
flew out of that large hangar.

256

00:11:55,600 --> 00:11:58,000

It was built for the "Macon."

257

00:11:58,000 --> 00:12:01,666

It was about 800 feet long,
enormous vehicle.

258

00:12:01,666 --> 00:12:05,566

And the funny--the interesting
to aeroengineers was that

259

00:12:05,566 --> 00:12:09,033

it had these little biplanes
that went up inside it.

260

00:12:09,033 --> 00:12:11,866

And when it wanted to fly away
and do surveying,

261

00:12:11,866 --> 00:12:13,566

it would let them down
on a hook.

262

00:12:13,566 --> 00:12:14,933

They would fly away.

263

00:12:14,933 --> 00:12:16,133

When they finished,
they'd come back

264

00:12:16,133 --> 00:12:17,466

and hook back on.

265

00:12:17,466 --> 00:12:19,800

And these little biplanes
did this for about

266

00:12:19,800 --> 00:12:21,066

a year and a half.

267

00:12:21,066 --> 00:12:23,833

And the "Macon" crashed
off the coast of California.

268

00:12:23,833 --> 00:12:26,266

And that was kind of the end
of the big zeppelin days.

269

00:12:26,266 --> 00:12:28,366

It crashed in 1935.

270

00:12:28,366 --> 00:12:30,966

But that just shows you
the centers then were formed,

271

00:12:30,966 --> 00:12:33,533

as I said, Ames in '39.

272

00:12:33,533 --> 00:12:36,100

Then Lewis came along in '40.

273

00:12:36,100 --> 00:12:39,600

And Dryden came along in '46.

274

00:12:39,600 --> 00:12:42,733

And those were the four centers
for NASA.

275

00:12:42,733 --> 00:12:45,300

Next chart is a little bit
more about that.

276

00:12:45,300 --> 00:12:47,366
These are--this is the committee
I mentioned

277
00:12:47,366 --> 00:12:49,000
that Lindbergh chaired.

278
00:12:49,000 --> 00:12:53,266
I understand that somebody--
at some point,

279
00:12:53,266 --> 00:12:54,800
people said,
"Why don't you name it

280
00:12:54,800 --> 00:12:57,000
Lindbergh Research Center?"

281
00:12:57,000 --> 00:12:58,833
But that never worked out.

282
00:12:58,833 --> 00:13:02,300
Ames--Dr. Ames was a very
prominent individual

283
00:13:02,300 --> 00:13:04,800
and a chairman of NACA.

284
00:13:04,800 --> 00:13:07,033
He never got a chance
to come and visit Ames,

285
00:13:07,033 --> 00:13:08,966
but they named the center
after him.

286
00:13:08,966 --> 00:13:11,933
He was a president of
Johns Hopkins University as well

287

00:13:11,933 --> 00:13:13,900
as the chairman of NACA.

288

00:13:13,900 --> 00:13:16,800
Next chart.

289

00:13:16,800 --> 00:13:18,333
Here we go again.

290

00:13:18,333 --> 00:13:20,466
This gives you a timeline
so you can see

291

00:13:20,466 --> 00:13:23,866
how the centers were formed,
Dr. Ames here at Ames.

292

00:13:23,866 --> 00:13:26,433
Then in '58,
these four centers

293

00:13:26,433 --> 00:13:28,166
were in existence here.

294

00:13:28,166 --> 00:13:29,433
That was it.

295

00:13:29,433 --> 00:13:32,666
And they were incorporated
into NASA right away.

296

00:13:32,666 --> 00:13:38,433
And the way NACA worked
was really quite independent

297

00:13:38,433 --> 00:13:40,166
in this sense.

298

00:13:40,166 --> 00:13:42,700

They were given a job to do
to develop

299

00:13:42,700 --> 00:13:45,866

research and technology
for improving

300

00:13:45,866 --> 00:13:47,466

air transportation.

301

00:13:47,466 --> 00:13:49,800

And they were kind of
left alone to do it.

302

00:13:49,800 --> 00:13:52,866

I forgot to mention that
the first budget of NACA

303

00:13:52,866 --> 00:13:55,933

when it was formed
was like \$5,000.

304

00:13:55,933 --> 00:13:58,266

\$5,000 a year was
the first budget.

305

00:13:58,266 --> 00:13:59,666

Now, there wasn't
a center then,

306

00:13:59,666 --> 00:14:01,733

and it wasn't until 1917.

307

00:14:01,733 --> 00:14:05,633

But that activity started,
and the many things

308

00:14:05,633 --> 00:14:07,400

that happened,

which I'll briefly mention

309

00:14:07,400 --> 00:14:09,100
before I quit here.

310

00:14:09,100 --> 00:14:13,033
Before NASA was formed,
toward the end,

311

00:14:13,033 --> 00:14:16,700
in the '50s, we started looking
and worrying about

312

00:14:16,700 --> 00:14:19,266
the fact that we someday
may go into space.

313

00:14:19,266 --> 00:14:21,900
So we needed to do something
other than just develop

314

00:14:21,900 --> 00:14:24,666
highly swept wings,
very thin wings,

315

00:14:24,666 --> 00:14:25,966
what have you.

316

00:14:25,966 --> 00:14:27,700
And I'll say a little bit
about that in a moment.

317

00:14:27,700 --> 00:14:29,666
Now, the next chart.

318

00:14:29,666 --> 00:14:32,766
The way--interesting
the way NACA worked

319

00:14:32,766 --> 00:14:35,133
in terms of its
data transfer.

320
00:14:35,133 --> 00:14:37,866
As a wind tunnel jockey,
I recall,

321
00:14:37,866 --> 00:14:40,400
we would take data
in our supersonic wind tunnel--

322
00:14:40,400 --> 00:14:42,666
lift, drag, pitching moment,
what have you--

323
00:14:42,666 --> 00:14:44,866
for different-shaped aircraft:

324
00:14:44,866 --> 00:14:47,133
triangular-winged aircraft,
sweptback wing,

325
00:14:47,133 --> 00:14:48,700
unswept wings.

326
00:14:48,700 --> 00:14:51,100
And before--almost before
we finished getting the data,

327
00:14:51,100 --> 00:14:52,900
the industry would settle
in here

328
00:14:52,900 --> 00:14:55,500
and actually take it away
with them sometimes.

329
00:14:55,500 --> 00:14:59,000
We published our own reports,

NACA reports,

330

00:14:59,000 --> 00:15:01,133
which were very famous
and very popular

331

00:15:01,133 --> 00:15:03,100
with the aircraft industry.

332

00:15:03,100 --> 00:15:06,966
And the industry--that was why
we were set up,

333

00:15:06,966 --> 00:15:11,000
to improve the aeronautical
activities of this country.

334

00:15:11,000 --> 00:15:13,433
And the industry took advantage
of us being here.

335

00:15:13,433 --> 00:15:15,633
By then, the four centers
were developing

336

00:15:15,633 --> 00:15:18,333
an enormous amount
of information in various ways.

337

00:15:18,333 --> 00:15:20,166
And to get it out
to them quickly,

338

00:15:20,166 --> 00:15:23,633
we have what we call
"technical inspections."

339

00:15:23,633 --> 00:15:25,366
They weren't called
"conferences,"

340

00:15:25,366 --> 00:15:27,400

though some people put
that name on it.

341

00:15:27,400 --> 00:15:30,633

The inspections were such
that we would invite industry

342

00:15:30,633 --> 00:15:33,100

and the academic folks
to come and visit us.

343

00:15:33,100 --> 00:15:36,066

We'd make presentations
to them

344

00:15:36,066 --> 00:15:39,133

on the data we'd accumulated,
perhaps only a month earlier,

345

00:15:39,133 --> 00:15:40,700

sometimes three or four.

346

00:15:40,700 --> 00:15:43,066

And they would see what
we had done

347

00:15:43,066 --> 00:15:44,666

and want it right away.

348

00:15:44,666 --> 00:15:46,466

And this is why
the aircraft industry

349

00:15:46,466 --> 00:15:48,733

was so, I guess,
taken with the fact

350

00:15:48,733 --> 00:15:52,833

that NACA was there
to give them free data.

351

00:15:52,833 --> 00:15:55,833

Now, we didn't charge them
for the data.

352

00:15:55,833 --> 00:15:58,533

We put it out in reports,
and they took it away with them.

353

00:15:58,533 --> 00:16:03,000

That's kind of the way
we disseminated information.

354

00:16:03,000 --> 00:16:04,833

Next chart,

355

00:16:04,833 --> 00:16:08,466

this is one of the inspections
that was held.

356

00:16:08,466 --> 00:16:09,966

Now most of you young--

357

00:16:09,966 --> 00:16:12,266

people are much,
much too young

358

00:16:12,266 --> 00:16:14,100

to remember
any of these people.

359

00:16:14,100 --> 00:16:16,666

But Dr. von Karman
was one of the most famous

360

00:16:16,666 --> 00:16:19,033

aerodynamicists

in the world.

361

00:16:19,033 --> 00:16:21,600

And he was in this country
working at Caltech.

362

00:16:21,600 --> 00:16:23,000

These are some
of the other people,

363

00:16:23,000 --> 00:16:26,066

Jimmy Doolittle, whose name
you might recall.

364

00:16:26,066 --> 00:16:29,733

He did the flight off the deck

365

00:16:29,733 --> 00:16:31,366

of a carrier into Japan.

366

00:16:31,366 --> 00:16:33,300

He was a member
of NACA, though.

367

00:16:33,300 --> 00:16:34,933

Another interesting thing
about him,

368

00:16:34,933 --> 00:16:39,666

he got the first PhD degree
from MIT, actually.

369

00:16:39,666 --> 00:16:42,166

Anyway, these are the kind
of people that were on there.

370

00:16:42,166 --> 00:16:45,133

This young fellow here,
you see him?

371

00:16:45,133 --> 00:16:48,633

That's the guy sitting up here
to my left.

372

00:16:48,633 --> 00:16:50,566

Vic was too young to be on here.

373

00:16:50,566 --> 00:16:52,266

He wasn't even here yet.

374

00:16:52,266 --> 00:16:55,300

I think he came in, what,
'53 or '54.

375

00:16:55,300 --> 00:16:57,766

Otherwise I'd add him here.

376

00:16:57,766 --> 00:17:00,333

R.T. Jones and Harvey Allen,
which I'll talk a little bit

377

00:17:00,333 --> 00:17:02,233

about later, were two
of the most famous

378

00:17:02,233 --> 00:17:04,033

aerodynamicists in the world.

379

00:17:04,033 --> 00:17:06,100

Not just in this country
or at this center,

380

00:17:06,100 --> 00:17:07,633

but in the whole world.

381

00:17:07,633 --> 00:17:10,433

But that's the kind of things
where we had to--

382

00:17:10,433 --> 00:17:13,200

I recall this one
particular one,

383

00:17:13,200 --> 00:17:14,533

and I was involved with it.

384

00:17:14,533 --> 00:17:15,733

Here I am.

385

00:17:15,733 --> 00:17:18,366

You can't recognize me,
but that's me.

386

00:17:18,366 --> 00:17:22,366

In the '50s--it was in 1950,
and I remember it vividly

387

00:17:22,366 --> 00:17:26,033

because that's the year
we got married.

388

00:17:26,033 --> 00:17:28,666

And we almost didn't,
because I was getting ready

389

00:17:28,666 --> 00:17:30,166

for this conference.

390

00:17:30,166 --> 00:17:32,033

And she said,
"If you're gonna pay

391

00:17:32,033 --> 00:17:33,433

that much attention
to the conference,

392

00:17:33,433 --> 00:17:35,133

what's gonna happen

after we're married?"

393

00:17:35,133 --> 00:17:37,233

I said, "I guess it'll be
the same thing."

394

00:17:37,233 --> 00:17:40,466

But anyway, we celebrated
our 65th wedding anniversary,

395

00:17:40,466 --> 00:17:41,833

so it worked.

396

00:17:41,833 --> 00:17:44,400

Next chart,
these are some of the major--

397

00:17:44,400 --> 00:17:47,133

I've got two charts here
on contributions.

398

00:17:47,133 --> 00:17:48,700

If you look at these carefully,

399

00:17:48,700 --> 00:17:51,133

you won't recognize
some of the activity.

400

00:17:51,133 --> 00:17:54,133

This is all of NACA,
not just Ames.

401

00:17:54,133 --> 00:17:55,833

Ames will come
a little bit later.

402

00:17:55,833 --> 00:17:59,466

The cowling, which reduced
the drag on aircraft,

403
00:17:59,466 --> 00:18:02,766
was developed
at Langley Research Center.

404
00:18:02,766 --> 00:18:05,600
The whole series of airfoils,
which is the way

405
00:18:05,600 --> 00:18:09,066
that wings were formed,
were developed, again,

406
00:18:09,066 --> 00:18:11,500
at the Langley Research Center.

407
00:18:11,500 --> 00:18:15,100
Icing research,
which was very, very

408
00:18:15,100 --> 00:18:19,666
active in the '30s and '40s,
was started here

409
00:18:19,666 --> 00:18:21,466
by a guy who got
the Collier Trophy

410
00:18:21,466 --> 00:18:23,966
and who moved to Glenn later.

411
00:18:23,966 --> 00:18:25,400
The sweptback wing--
and this was

412
00:18:25,400 --> 00:18:27,933
an interesting story.

413
00:18:27,933 --> 00:18:31,300
Dr. Vincenti might challenge me

on what I say here,

414

00:18:31,300 --> 00:18:33,533

because I've never gotten it
totally straight.

415

00:18:33,533 --> 00:18:37,033

R.T. Jones started
at Langley Field

416

00:18:37,033 --> 00:18:39,833

and started the concept
of sweeping wings back

417

00:18:39,833 --> 00:18:41,700

to reduce the drag,
and improve

418

00:18:41,700 --> 00:18:44,766

the lift-to-drag ratio.

419

00:18:44,766 --> 00:18:48,200

He came to Ames in the early
'40s himself

420

00:18:48,200 --> 00:18:51,800

and continued that work.

421

00:18:51,800 --> 00:18:55,033

I understand that Langley Field,
when he first got the concept,

422

00:18:55,033 --> 00:18:56,733

they wouldn't let him
publish the data

423

00:18:56,733 --> 00:18:58,566

because they thought
he was crazy.

424

00:18:58,566 --> 00:19:00,133

Why sweep a wing back?

425

00:19:00,133 --> 00:19:04,800

Well, he proved that
his concept was right.

426

00:19:04,800 --> 00:19:06,300

Now, what really happened then,

427

00:19:06,300 --> 00:19:08,733

a fellow in Germany by the name
of Busemann

428

00:19:08,733 --> 00:19:10,933

was developing the sweptback
wing at the very same time

429

00:19:10,933 --> 00:19:12,200

R.T. was.

430

00:19:12,200 --> 00:19:14,366

Because of the wartime,
they weren't permitted

431

00:19:14,366 --> 00:19:15,633

to talk to each other.

432

00:19:15,633 --> 00:19:18,133

So they developed it
separately,

433

00:19:18,133 --> 00:19:20,900

and both of them became famous
for having this done.

434

00:19:20,900 --> 00:19:23,333

Now, this is on every
aircraft now that flies--

435

00:19:23,333 --> 00:19:28,200
in the world--that flies
above 400 or 500 miles an hour.

436

00:19:28,200 --> 00:19:30,466
And at the end of the war,
Busemann came over

437

00:19:30,466 --> 00:19:32,600
to the University of Colorado,
and he and R.T.

438

00:19:32,600 --> 00:19:34,166
became very good friends.

439

00:19:34,166 --> 00:19:38,066
And Mach 1, supersonic,
at Dryden,

440

00:19:38,066 --> 00:19:40,433
this guy's name is Chuck Yeager.

441

00:19:40,433 --> 00:19:45,566
1947 is the year he broke
the sound barrier at Dryden.

442

00:19:45,566 --> 00:19:47,733
Transonic area rule,
which again,

443

00:19:47,733 --> 00:19:50,766
is changing the shape
of the fuselage

444

00:19:50,766 --> 00:19:54,566
at the root of the wing
to reduce the drag,

445

00:19:54,566 --> 00:19:57,266
this was done by a man
named Whitcomb at Langley Field.

446
00:19:57,266 --> 00:20:00,466
This is something I worked on
with this young fellow here

447
00:20:00,466 --> 00:20:01,933
called conical camber.

448
00:20:01,933 --> 00:20:04,400
It was another way
to reduce the lag--

449
00:20:04,400 --> 00:20:09,300
improve the L/D ratio
of triangular sweptback wings.

450
00:20:09,300 --> 00:20:15,233
For an interesting story here,

451
00:20:15,233 --> 00:20:19,000
I was a project manager
in the 6x6 foot wind tunnel

452
00:20:19,000 --> 00:20:21,266
on this project.

453
00:20:21,266 --> 00:20:24,400
A gentleman from the outside
in the Air Force

454
00:20:24,400 --> 00:20:27,266
by the name of Deutschendorf
was a project manager.

455
00:20:27,266 --> 00:20:28,833
And he came to Ames quite often.

456

00:20:28,833 --> 00:20:30,733

And we tested this thing
together.

457

00:20:30,733 --> 00:20:32,933

It was put on the B-58 bomber,
actually,

458

00:20:32,933 --> 00:20:35,900

beautiful bomber,
Mach 2 bomber.

459

00:20:35,900 --> 00:20:37,500

He would always bring
two little boys

460

00:20:37,500 --> 00:20:40,800

along with him
named Ron and John.

461

00:20:40,800 --> 00:20:44,166

And it turned out
10 years later,

462

00:20:44,166 --> 00:20:45,733

15 years later,
he called me and said,

463

00:20:45,733 --> 00:20:47,833

"I'm going to the city
to hear my son sing.

464

00:20:47,833 --> 00:20:48,933

Do you want to come?"

465

00:20:48,933 --> 00:20:50,633

I said,
"Yeah, but who's your son?"

466

00:20:50,633 --> 00:20:52,333

He said,
"His name is Denver.

467

00:20:52,333 --> 00:20:54,100

He changed his name
from Deutschendorf

468

00:20:54,100 --> 00:20:55,300

to John Denver."

469

00:20:55,300 --> 00:20:57,233

So that's how we got
to know John Denver.

470

00:20:57,233 --> 00:20:58,833

Now, the last thing
on there is

471

00:20:58,833 --> 00:21:00,200

a re-entry technology.

472

00:21:00,200 --> 00:21:01,733

It's a blunt body.

473

00:21:01,733 --> 00:21:05,266

Another gentleman here thought,
okay, we're going

474

00:21:05,266 --> 00:21:06,966

Mach 2, 3, 4.

475

00:21:06,966 --> 00:21:09,166

You want sharp wings,
sweptback wings.

476

00:21:09,166 --> 00:21:12,566

But if you're going really fast,
like orbiting the Earth

477

00:21:12,566 --> 00:21:14,466
or coming back from the moon,
you'll be going

478

00:21:14,466 --> 00:21:17,633
25,000 miles an hour,
and you want to make sure

479

00:21:17,633 --> 00:21:19,233
you don't burn the thing up.

480

00:21:19,233 --> 00:21:20,800
And therefore,
make the body blunt

481

00:21:20,800 --> 00:21:22,266
to take the heat away.

482

00:21:22,266 --> 00:21:23,966
And it'll survive that way.

483

00:21:23,966 --> 00:21:25,833
He developed
the blunt body concept,

484

00:21:25,833 --> 00:21:28,833
which itself, again,
is on every vehicle

485

00:21:28,833 --> 00:21:30,333
that goes into the atmosphere.

486

00:21:30,333 --> 00:21:32,200
Next chart--I think
I'm about finished.

487

00:21:32,200 --> 00:21:36,066
Next chart.

488
00:21:36,066 --> 00:21:41,200
No, skip that one.
Just go.

489
00:21:41,200 --> 00:21:43,233
I'll finish that thing,
but keep going.

490
00:21:43,233 --> 00:21:44,700
We've done that enough.

491
00:21:44,700 --> 00:21:46,500
These are all too long.
Let's go.

492
00:21:46,500 --> 00:21:48,433
Keep going.
Keep going.

493
00:21:48,433 --> 00:21:50,533
We've talked about that.
We've talked about that.

494
00:21:50,533 --> 00:21:53,166
Done that.
Done that.

495
00:21:53,166 --> 00:21:55,800
Okay.

496
00:21:55,800 --> 00:21:56,933
That's it?

497
00:21:56,933 --> 00:21:58,500
Keep going.

498
00:21:58,500 --> 00:22:00,800
That's what we do.

499

00:22:00,800 --> 00:22:02,833

Here's the legacy
that lives on in NASA

500

00:22:02,833 --> 00:22:04,566

from NACA.

501

00:22:04,566 --> 00:22:06,800

How we work in partnership
with the industry,

502

00:22:06,800 --> 00:22:09,900

we do it with industry,
universities around the world,

503

00:22:09,900 --> 00:22:11,466

not just in this country.

504

00:22:11,466 --> 00:22:15,066

And what we do is research
on solving problems

505

00:22:15,066 --> 00:22:18,466

related to aircraft
and spacecraft flight.

506

00:22:18,466 --> 00:22:22,033

And who we hire--
brilliant, inquisitive folks

507

00:22:22,033 --> 00:22:23,633

like all of you in the room.

508

00:22:23,633 --> 00:22:25,700

If you turn out to be
inquisitive and bright enough

509

00:22:25,700 --> 00:22:29,866

and want to, we might hire you,

like, ten years from now,

510

00:22:29,866 --> 00:22:32,533

when you finish--

511

00:22:32,533 --> 00:22:36,233

And the next and last chart,

if that's not the last one--

512

00:22:36,233 --> 00:22:37,666

That's it.

513

00:22:37,666 --> 00:22:40,033

Okay, that's all I've got

to say about it.

514

00:22:40,033 --> 00:22:43,033

[applause]

515

00:22:45,733 --> 00:22:48,433

- Thank you, Jack.

- Okay.

516

00:22:48,433 --> 00:22:50,466

- And now, Walter,

it's your turn.

517

00:22:50,466 --> 00:22:52,033

Walter,

it's your turn to talk.

518

00:22:52,033 --> 00:22:56,033

If we could hear a few minutes

of reminiscences from you.

519

00:22:56,033 --> 00:22:59,466

- I'm sorry,

I couldn't hear you, Glenn.

520

00:22:59,466 --> 00:23:00,866
- It's time for you to talk.

521
00:23:00,866 --> 00:23:01,866
- What?

522
00:23:01,866 --> 00:23:03,966
- Talk.

523
00:23:03,966 --> 00:23:05,766
It's time for you
to talk to the folks.

524
00:23:05,766 --> 00:23:09,833
- They tell me it's all right
if I talk sitting here.

525
00:23:09,833 --> 00:23:13,933
I want to thank you, Glenn,
for inviting me to do this.

526
00:23:13,933 --> 00:23:17,866
At my age of 98,
it's a pleasure

527
00:23:17,866 --> 00:23:22,100
to be able to participate.

528
00:23:22,100 --> 00:23:28,533
I was employed here
at the Ames Research Center

529
00:23:28,533 --> 00:23:33,433
on June 1st of 1940,

530
00:23:33,433 --> 00:23:35,366
which is almost exactly

531
00:23:35,366 --> 00:23:38,233

75 years ago.

532

00:23:38,233 --> 00:23:42,400

I was very fortunate
to have that position.

533

00:23:42,400 --> 00:23:48,166

Ames was just started.

534

00:23:48,166 --> 00:23:52,633

I was the fourth engineer
on the staff.

535

00:23:52,633 --> 00:23:57,266

The three ahead of me had come
from Langley Field, Virginia,

536

00:23:57,266 --> 00:24:02,366

which was the NACA's

537

00:24:02,366 --> 00:24:06,000

National Advisory Committee
for Aeronautics.

538

00:24:06,000 --> 00:24:09,366

Space hadn't been invented yet.

539

00:24:09,366 --> 00:24:14,466

And the--there were
three people

540

00:24:14,466 --> 00:24:17,533

from Langley Field,

541

00:24:17,533 --> 00:24:21,800

and I was
the fourth person hired.

542

00:24:21,800 --> 00:24:24,200

I had just finished
my two years

543
00:24:24,200 --> 00:24:28,400
of graduate work at Stanford.

544
00:24:28,400 --> 00:24:31,000
It was fortunate that

545
00:24:31,000 --> 00:24:34,633
Ames was being put here.

546
00:24:34,633 --> 00:24:40,566
It was interesting that they--

547
00:24:40,566 --> 00:24:43,233
Have to--

548
00:24:43,233 --> 00:24:48,966
The NACA

549
00:24:48,966 --> 00:24:53,633
wanted to establish a laboratory
on the Pacific coast

550
00:24:53,633 --> 00:24:57,400
to supplement their
lab--original laboratory

551
00:24:57,400 --> 00:24:59,633
at Langley Field, Virginia.

552
00:24:59,633 --> 00:25:02,766
And...

553
00:25:02,766 --> 00:25:07,466
the aircraft industry

554

00:25:07,466 --> 00:25:11,933
was very much concentrated
in Los Angeles.

555
00:25:11,933 --> 00:25:15,033
And they wanted
the laboratory down there,

556
00:25:15,033 --> 00:25:20,133
as did the people
at Caltech.

557
00:25:20,133 --> 00:25:23,533
But the people
in Washington

558
00:25:23,533 --> 00:25:28,533
thought that to be right
next door to the industry

559
00:25:28,533 --> 00:25:33,133
would be asking for daily--
for visitors every day,

560
00:25:33,133 --> 00:25:36,466
because all the people
in the aircraft companies

561
00:25:36,466 --> 00:25:38,933
would have to do would be
to get in their car

562
00:25:38,933 --> 00:25:41,733
and drive for an hour or so,
and they'd be

563
00:25:41,733 --> 00:25:43,100
at the laboratory.

564
00:25:43,100 --> 00:25:46,300

So they wanted to be
on the Pacific coast,

565

00:25:46,300 --> 00:25:52,300
but to be an overnight trip

566

00:25:52,300 --> 00:25:54,900
from Los Angeles
was attractive.

567

00:25:54,900 --> 00:25:58,233
So they decided to put
the laboratory here

568

00:25:58,233 --> 00:26:00,466
at Moffett Field,

569

00:26:00,466 --> 00:26:03,700
which at that time,
was just the base

570

00:26:03,700 --> 00:26:08,400
for the dirigible hangar

571

00:26:08,400 --> 00:26:10,666
behind us here

572

00:26:10,666 --> 00:26:13,766
and a naval base

573

00:26:13,766 --> 00:26:17,500
and about a half a dozen
buildings.

574

00:26:17,500 --> 00:26:23,000
So when I came--

575

00:26:23,000 --> 00:26:26,900
When I came here

576

00:26:26,900 --> 00:26:34,366
on June the 1st
of 1940,

577

00:26:34,366 --> 00:26:37,266
the Ames laboratory consisted

578

00:26:37,266 --> 00:26:39,966
of a construction shack.

579

00:26:39,966 --> 00:26:43,133
That was all there was,
no paved roads.

580

00:26:43,133 --> 00:26:48,500
It was off to the north side
of the naval base.

581

00:26:48,500 --> 00:26:54,500
And there was a half-built
flight hangar.

582

00:26:54,500 --> 00:26:57,700
And that was it.

583

00:26:57,700 --> 00:27:00,600
The staff consisted
of three people

584

00:27:00,600 --> 00:27:02,866
from Langley Field.

585

00:27:02,866 --> 00:27:07,700
And I was the fourth person
on the staff.

586

00:27:07,700 --> 00:27:12,633
So I grew up with

587

00:27:12,633 --> 00:27:15,166
the Ames laboratory.

588

00:27:15,166 --> 00:27:19,000
The--my work

589

00:27:19,000 --> 00:27:22,100
in the first years

590

00:27:22,100 --> 00:27:25,300
was largely construction work

591

00:27:25,300 --> 00:27:27,533
on the first wind tunnels,

592

00:27:27,533 --> 00:27:32,100
two 7x10 foot subsonic tunnels,

593

00:27:32,100 --> 00:27:35,533
the high-speed 16 foot tunnel,

594

00:27:35,533 --> 00:27:38,200
and that was it.

595

00:27:38,200 --> 00:27:44,266
The 40x80 full-scale tunnel
was under construction,

596

00:27:44,266 --> 00:27:52,500
as was the 7x10.

597

00:27:52,500 --> 00:27:56,466
And so I participated
for the first years

598

00:27:56,466 --> 00:28:00,133
in construction.

599

00:28:00,133 --> 00:28:04,300

Then, after about three years
of that,

600

00:28:04,300 --> 00:28:09,500

we started to build--
to work in doing research

601

00:28:09,500 --> 00:28:12,133

in supersonic flow,

602

00:28:12,133 --> 00:28:17,233

which in those days,
was almost unheard of.

603

00:28:17,233 --> 00:28:21,533

The only people who had
done anything in supersonics

604

00:28:21,533 --> 00:28:23,433

were the Germans.

605

00:28:23,433 --> 00:28:26,433

The only literature
we had to go on

606

00:28:26,433 --> 00:28:31,066

were publications
from Germany.

607

00:28:31,066 --> 00:28:37,066

And so we were largely
on our own.

608

00:28:37,066 --> 00:28:40,233

The--

609

00:28:40,233 --> 00:28:43,566

I was fortunate

610

00:28:43,566 --> 00:28:48,766
to be in charge of the first
supersonic tunnel

611

00:28:48,766 --> 00:28:50,533
to be built here.

612

00:28:50,533 --> 00:28:52,200
It was the second--

613

00:28:52,200 --> 00:28:55,633
It was one of the first two
supersonic tunnels

614

00:28:55,633 --> 00:28:58,200
to be built
in the United States,

615

00:28:58,200 --> 00:29:00,133
the other one being

616

00:29:00,133 --> 00:29:03,100
at the naval base

617

00:29:03,100 --> 00:29:06,766
on the east coast.

618

00:29:06,766 --> 00:29:10,066
And as I say,
all we had to go on

619

00:29:10,066 --> 00:29:15,633
was what publications

620

00:29:15,633 --> 00:29:19,266
we could get--
find from Germany.

621
00:29:22,433 --> 00:29:24,766
So we were on our own.

622
00:29:24,766 --> 00:29:28,500
And I was put in charge

623
00:29:28,500 --> 00:29:32,933
of the first supersonic tunnel.

624
00:29:32,933 --> 00:29:37,366
And I had a staff
of about 20 engineers

625
00:29:37,366 --> 00:29:39,400
working with me.

626
00:29:39,400 --> 00:29:44,166
And I was--we were
very fortunate

627
00:29:44,166 --> 00:29:48,266
in the engineers
that we had.

628
00:29:48,266 --> 00:29:53,366
Of those 20 or so engineers,
4 of them

629
00:29:53,366 --> 00:29:55,700
were project engineers.

630
00:29:55,700 --> 00:29:58,900
And I met with my
project engineers

631
00:29:58,900 --> 00:30:01,700
every Friday afternoon.

632

00:30:01,700 --> 00:30:03,866

And we would have a discussion.

633

00:30:03,866 --> 00:30:09,000

The kind of thing
we were doing

634

00:30:09,000 --> 00:30:12,933

had no supervision
from the front office.

635

00:30:12,933 --> 00:30:17,166

They knew less about
supersonic flow than we did.

636

00:30:17,166 --> 00:30:19,966

And we learned it
as we went along

637

00:30:19,966 --> 00:30:24,333

and made it up.

638

00:30:24,333 --> 00:30:27,066

The--I had a group

639

00:30:27,066 --> 00:30:31,266

of four project engineers.

640

00:30:33,366 --> 00:30:37,800

Of the four--the five of us
who met every Friday afternoon

641

00:30:37,800 --> 00:30:40,066

to discuss what we were doing

642

00:30:40,066 --> 00:30:43,866

and learn about supersonics

643

00:30:43,866 --> 00:30:47,500
from each other,

644
00:30:47,500 --> 00:30:51,333
three of them had
bachelor's degrees,

645
00:30:51,333 --> 00:30:53,766
no PhDs, no--

646
00:30:53,766 --> 00:30:56,500
One had a master's degree.

647
00:30:56,500 --> 00:31:00,100
And I had two years
for an engineer's degree

648
00:31:00,100 --> 00:31:01,466
from Stanford.

649
00:31:01,466 --> 00:31:05,133
And that was all that we had
as background.

650
00:31:07,433 --> 00:31:11,633
We had no supervision
from the front office

651
00:31:11,633 --> 00:31:14,266
because as I believe I said,

652
00:31:14,266 --> 00:31:18,333
they knew less about
supersonic flow than we did.

653
00:31:18,333 --> 00:31:23,733
And we simply learned about it
as we went along.

654

00:31:23,733 --> 00:31:26,866

In the--in our--

655

00:31:26,866 --> 00:31:31,000

Every Friday afternoon,
we had a meeting

656

00:31:31,000 --> 00:31:35,233

of the project engineers
and taught each other

657

00:31:35,233 --> 00:31:40,400

what we had learned
in the preceding week.

658

00:31:40,400 --> 00:31:44,300

Now these--as I say,
these people were--

659

00:31:44,300 --> 00:31:47,700

None of us had PhDs.

660

00:31:47,700 --> 00:31:52,333

After the war,

661

00:31:52,333 --> 00:31:57,433

three of the five of us
went back to Caltech

662

00:31:57,433 --> 00:31:59,466

and got PhDs

663

00:31:59,466 --> 00:32:03,233

and then came back to work
here at Ames.

664

00:32:03,233 --> 00:32:06,500

They were names that
you might have run across:

665
00:32:06,500 --> 00:32:10,133
Dean Chapman,
Milton van Dyke,

666
00:32:10,133 --> 00:32:14,466
and Jack Nielsen.

667
00:32:14,466 --> 00:32:18,866
These were very
remarkable people.

668
00:32:18,866 --> 00:32:21,366
Of these--

669
00:32:21,366 --> 00:32:26,133
of the five of us,

670
00:32:26,133 --> 00:32:29,100
four of us went on
and became members

671
00:32:29,100 --> 00:32:33,366
of the National Academy
of Engineering.

672
00:32:33,366 --> 00:32:37,800
The other one dropped out
of aeronautics

673
00:32:37,800 --> 00:32:43,400
and became a member of...

674
00:32:46,233 --> 00:32:48,533
The people here in the valley

675
00:32:48,533 --> 00:32:53,800
who were...

676

00:32:53,800 --> 00:33:00,866
fostering the new Silicon Valley
corporations.

677
00:33:00,866 --> 00:33:05,100
And he probably made
more money

678
00:33:05,100 --> 00:33:07,366
than the other four of us
put together,

679
00:33:07,366 --> 00:33:14,066
who, as I say, became members
of the National Academy.

680
00:33:14,066 --> 00:33:16,133
- You might know
that R.T. Jones

681
00:33:16,133 --> 00:33:18,433
that I mentioned didn't
have a degree at all.

682
00:33:18,433 --> 00:33:22,100
- Yes, yes, R.T. Jones,
who came out here

683
00:33:22,100 --> 00:33:24,100
from Langley Field,

684
00:33:24,100 --> 00:33:27,833
only--and this he didn't
have at the time--

685
00:33:27,833 --> 00:33:30,166
His only college degree

686
00:33:30,166 --> 00:33:33,500
was an honorary doctor's degree,

687

00:33:33,500 --> 00:33:38,466

which he got from
the University of Colorado

688

00:33:38,466 --> 00:33:43,200

at the behest
of Adolf Busemann.

689

00:33:43,200 --> 00:33:45,866

So he was a remarkable person.

690

00:33:45,866 --> 00:33:49,566

He had an office right across
the hall from me.

691

00:33:49,566 --> 00:33:53,000

And R.T. and I got to know
each other quite well

692

00:33:53,000 --> 00:33:54,266

and worked together.

693

00:33:54,266 --> 00:33:55,666

- Time.

- But--

694

00:33:55,666 --> 00:33:56,666

- Time.

695

00:33:56,666 --> 00:33:58,100

- My time already?

696

00:33:58,100 --> 00:34:00,266

Well, I could go on
reminiscing

697

00:34:00,266 --> 00:34:04,566

for the rest of the hour, but--

698

00:34:04,566 --> 00:34:06,633

- We can do it
over cocktails.

699

00:34:06,633 --> 00:34:08,000

- It's been a great pleasure.

700

00:34:08,000 --> 00:34:09,033

Thank you.

701

00:34:09,033 --> 00:34:12,033

[applause]

702

00:34:16,933 --> 00:34:19,666

- And for those of you
who would like to know more,

703

00:34:19,666 --> 00:34:21,666

of course, you can read
Walter's book.

704

00:34:21,666 --> 00:34:24,166

The NASA History Office
did a series

705

00:34:24,166 --> 00:34:26,066

of oral history interviews
with all three

706

00:34:26,066 --> 00:34:27,333

of these gentlemen.

707

00:34:27,333 --> 00:34:28,900

And if you go to the
NASA History Office webpage

708

00:34:28,900 --> 00:34:30,666

and look under

oral history interviews,

709

00:34:30,666 --> 00:34:32,700

you can see more of
their comments there.

710

00:34:32,700 --> 00:34:34,900

And now, Victor?

711

00:34:34,900 --> 00:34:36,333

Would you like to sit there
or up here?

712

00:34:36,333 --> 00:34:38,233

Up to you.

713

00:34:44,366 --> 00:34:46,100

- Well, I'll try to be brief,

714

00:34:46,100 --> 00:34:49,333

because I know that time
is a little short.

715

00:34:49,333 --> 00:34:52,966

I was a student
at Oregon State University

716

00:34:52,966 --> 00:34:56,366

back in the early to mid '50s.

717

00:34:56,366 --> 00:34:59,300

And I was in the aeronautical
engineering program.

718

00:34:59,300 --> 00:35:02,433

And at that time,

719

00:35:02,433 --> 00:35:06,266

NACA was an obscure

organization.

720

00:35:06,266 --> 00:35:08,300

If you stopped anybody
on the street

721

00:35:08,300 --> 00:35:11,500

and said you were thinking
about working at NACA,

722

00:35:11,500 --> 00:35:14,000

they would not have
an idea at all

723

00:35:14,000 --> 00:35:15,566

of what that meant.

724

00:35:15,566 --> 00:35:20,066

And, in fact, when I was
getting ready to graduate,

725

00:35:20,066 --> 00:35:23,000

all of the action was
in the southern California

726

00:35:23,000 --> 00:35:24,566

aircraft companies.

727

00:35:24,566 --> 00:35:29,966

The first supersonic
airplane flight--level flight--

728

00:35:29,966 --> 00:35:33,300

was the F-100 in 1953.

729

00:35:33,300 --> 00:35:37,000

And there was a big race
going on to see

730

00:35:37,000 --> 00:35:40,533
which company down there
could come up with a design

731
00:35:40,533 --> 00:35:45,066
for the next supersonic
military fighter.

732
00:35:45,066 --> 00:35:49,166
So all of the students,
when they were thinking

733
00:35:49,166 --> 00:35:52,400
about places to work,
they only thought about LA

734
00:35:52,400 --> 00:35:54,533
and the aircraft companies.

735
00:35:54,533 --> 00:35:58,533
Well, it turns out that
the senior class--

736
00:35:58,533 --> 00:36:00,700
we had a small class
of about 15 people

737
00:36:00,700 --> 00:36:02,366
in aeronautical engineering.

738
00:36:02,366 --> 00:36:05,033
The senior class arranged
to have a recruiting

739
00:36:05,033 --> 00:36:09,900
field trip down to LA
to look at these companies.

740
00:36:09,900 --> 00:36:12,666
And on the way down,

we stopped at Ames

741

00:36:12,666 --> 00:36:14,600
and had a tour.

742

00:36:14,600 --> 00:36:18,500
And so when I planted my foot
on, first time at Ames,

743

00:36:18,500 --> 00:36:20,033
I said,
"This is where I want to work,"

744

00:36:20,033 --> 00:36:21,833
even though I had not
seen the rest.

745

00:36:21,833 --> 00:36:23,466
So anyway, we went
on the field trip,

746

00:36:23,466 --> 00:36:27,533
and all I saw was rooms of--
hundreds of engineers

747

00:36:27,533 --> 00:36:30,033
in a room sitting
at drafting tables

748

00:36:30,033 --> 00:36:33,533
working on little pieces
of a design of an aircraft.

749

00:36:33,533 --> 00:36:36,766
And so I thought to myself,
what do I want to do?

750

00:36:36,766 --> 00:36:38,600
Do I want to do that,
or do I want to come

751

00:36:38,600 --> 00:36:41,166
to this university campus here?

752

00:36:41,166 --> 00:36:44,366
So I applied to come to Ames
and was hired.

753

00:36:44,366 --> 00:36:48,400
And never was--
never regretted it.

754

00:36:48,400 --> 00:36:51,066
The reason most people
didn't come to an organization

755

00:36:51,066 --> 00:36:52,900
like Ames or Langley
at that time

756

00:36:52,900 --> 00:36:56,133
was their tremendous
salary differential.

757

00:36:56,133 --> 00:37:00,066
I turned down starting
salaries of more than twice

758

00:37:00,066 --> 00:37:01,833
what I could get here.

759

00:37:01,833 --> 00:37:03,966
And most of the kids
at that time

760

00:37:03,966 --> 00:37:08,033
were thinking about the money,
and took the jobs in industry.

761

00:37:08,033 --> 00:37:12,666

So I graduated in '56
and came to Ames.

762

00:37:12,666 --> 00:37:16,966

And my first assignment
was to work

763

00:37:16,966 --> 00:37:20,600

in the 6x6 foot supersonic
tunnel, it was called.

764

00:37:20,600 --> 00:37:25,200

And actually, it was
the premier facility, almost,

765

00:37:25,200 --> 00:37:29,366

for that era, because it had
a continuously variable

766

00:37:29,366 --> 00:37:31,800

Mach number range,
from 6/10 Mach number

767

00:37:31,800 --> 00:37:33,433

up to 2.2.

768

00:37:33,433 --> 00:37:35,133

And you could test all the way
through this

769

00:37:35,133 --> 00:37:36,600

transonic speed range,

770

00:37:36,600 --> 00:37:41,166

which was really giving
the companies the fits.

771

00:37:41,166 --> 00:37:43,333

How do we get through

that transonic speed range,

772

00:37:43,333 --> 00:37:46,333

build an airplane that will
still have enough power

773

00:37:46,333 --> 00:37:49,466

to go on at higher
Mach numbers?

774

00:37:49,466 --> 00:37:52,033

First day I came in,
I was given

775

00:37:52,033 --> 00:37:53,466

a personal computer.

776

00:37:53,466 --> 00:37:55,866

And the personal computer
was a 20-inch

777

00:37:55,866 --> 00:37:59,666

K&E slide rule.

778

00:37:59,666 --> 00:38:02,233

The real computers at Ames,
in those days,

779

00:38:02,233 --> 00:38:04,633

were rooms full
of mostly women

780

00:38:04,633 --> 00:38:07,200

sitting at mechanical
calculators

781

00:38:07,200 --> 00:38:10,166

and pounding away all day long,
eight hours a day,

782

00:38:10,166 --> 00:38:12,500

day after day.

783

00:38:12,500 --> 00:38:17,933

And that was our computing
power back in those days.

784

00:38:21,533 --> 00:38:23,466

Most new engineers,
when they came in,

785

00:38:23,466 --> 00:38:24,933

if they were assigned
to a wind tunnel

786

00:38:24,933 --> 00:38:28,000

operation facility,
the first six months

787

00:38:28,000 --> 00:38:31,466

you were expected to learn
all about the wind tunnel

788

00:38:31,466 --> 00:38:34,200

and how to operate it
and all that sort of stuff.

789

00:38:34,200 --> 00:38:37,166

And we used to complain
to our managers at the time,

790

00:38:37,166 --> 00:38:38,566

"Why do we have to do this?"

791

00:38:38,566 --> 00:38:40,433

We went to college
to get a degree

792

00:38:40,433 --> 00:38:42,200

and do aeronautical research,

793

00:38:42,200 --> 00:38:44,166

and now we're running
a wind tunnel."

794

00:38:44,166 --> 00:38:47,033

And it turned out that was
the most wise thing

795

00:38:47,033 --> 00:38:48,266

that could've happened,

796

00:38:48,266 --> 00:38:50,633

because in order to develop
a good experiment

797

00:38:50,633 --> 00:38:53,633

for a facility,
you first have to understand,

798

00:38:53,633 --> 00:38:57,400

very carefully,
what the capabilities

799

00:38:57,400 --> 00:39:00,133

of that facility are
and how it worked

800

00:39:00,133 --> 00:39:01,133

and that sort of thing.

801

00:39:01,133 --> 00:39:05,200

So after the six months,

802

00:39:05,200 --> 00:39:08,600

then we could go on
and do our research.

803

00:39:08,600 --> 00:39:10,666

But at that time,
it was also

804

00:39:10,666 --> 00:39:13,000
quite different from Ames today

805

00:39:13,000 --> 00:39:17,700
in the sense that every position
at Ames was a government job.

806

00:39:17,700 --> 00:39:21,200
There were absolutely
no contract positions.

807

00:39:21,200 --> 00:39:23,866
We didn't have, really,
any student program

808

00:39:23,866 --> 00:39:25,233
in the summer.

809

00:39:25,233 --> 00:39:28,233
The guards at the gate
were civil servants,

810

00:39:28,233 --> 00:39:30,433
the people
that swept the floors,

811

00:39:30,433 --> 00:39:32,000
the people that delivered
the mail,

812

00:39:32,000 --> 00:39:33,866
the shop people.

813

00:39:33,866 --> 00:39:35,933
Everybody was
a government worker.

814

00:39:35,933 --> 00:39:37,266

There were no--

815

00:39:37,266 --> 00:39:40,400

So our staff was actually quite small at that time.

816

00:39:40,400 --> 00:39:43,166

It was between, I think, around 800 to 1,000 people

817

00:39:43,166 --> 00:39:47,733

at Ames at that time.

818

00:39:47,733 --> 00:39:51,833

Anyway, I started off doing work on looking

819

00:39:51,833 --> 00:39:56,266

at possible supersonic aircraft configurations,

820

00:39:56,266 --> 00:40:00,700

studied a lot of configurations that had either swept wings

821

00:40:00,700 --> 00:40:04,500

or straight wings

822

00:40:04,500 --> 00:40:06,933

or triangular wings

823

00:40:06,933 --> 00:40:08,900

and all kinds of different vertical tail

824

00:40:08,900 --> 00:40:11,333

and horizontal tail

configurations

825

00:40:11,333 --> 00:40:14,866
and control surfaces.

826

00:40:14,866 --> 00:40:19,300
We didn't have travel
to professional meetings

827

00:40:19,300 --> 00:40:20,733
and that sort of thing
at that time.

828

00:40:20,733 --> 00:40:23,033
And all of our work
was pretty much reported

829

00:40:23,033 --> 00:40:26,666
in either the NACA
technical notes

830

00:40:26,666 --> 00:40:29,200
or the technical reports.

831

00:40:29,200 --> 00:40:34,700
And these reports
were meticulously reviewed

832

00:40:34,700 --> 00:40:37,000
before they could be published.

833

00:40:37,000 --> 00:40:40,800
Every report that came along,

834

00:40:40,800 --> 00:40:42,100
a review committee would be

835

00:40:42,100 --> 00:40:45,700
set up, five or six people.

836

00:40:45,700 --> 00:40:48,700

That review committee
would go through everything

837

00:40:48,700 --> 00:40:50,000

in the report
and make sure it all

838

00:40:50,000 --> 00:40:53,900

held together and made sense.

839

00:40:53,900 --> 00:40:56,300

We transferred our information,
as Jack mentioned,

840

00:40:56,300 --> 00:40:59,466

largely through visits
from aircraft companies.

841

00:40:59,466 --> 00:41:01,433

The aircraft companies
would come here,

842

00:41:01,433 --> 00:41:03,000

tell us what
their problems were.

843

00:41:03,000 --> 00:41:05,833

And we would tell them
what we were working on

844

00:41:05,833 --> 00:41:08,933

that could help
with those problems.

845

00:41:08,933 --> 00:41:11,833

Well, then NASA came along
in '58.

846

00:41:11,833 --> 00:41:15,833

And immediately,

847

00:41:15,833 --> 00:41:17,200

some of us started to think,

848

00:41:17,200 --> 00:41:18,466

well, how can we--

849

00:41:18,466 --> 00:41:20,666

We've been working in
supersonic aerodynamics,

850

00:41:20,666 --> 00:41:24,133

what can we do to support
the space program?

851

00:41:24,133 --> 00:41:26,600

So a number of us started
to think about,

852

00:41:26,600 --> 00:41:29,900

well, what are the atmospheres
of the other planets?

853

00:41:29,900 --> 00:41:31,733

Are they--they're not air.

854

00:41:31,733 --> 00:41:32,733

What are they made up of?

855

00:41:32,733 --> 00:41:35,100

You know, it turned out
carbon dioxide,

856

00:41:35,100 --> 00:41:37,266

nitrogen, that sort of thing.

857

00:41:37,266 --> 00:41:38,800

So we asked ourselves
the question,

858

00:41:38,800 --> 00:41:40,133

well, how would a--

859

00:41:40,133 --> 00:41:41,866

What would the aerodynamics
of a vehicle

860

00:41:41,866 --> 00:41:43,566

flying in those gases,

861

00:41:43,566 --> 00:41:45,433

how would that differ
from flying

862

00:41:45,433 --> 00:41:48,166

in the atmosphere of air?

863

00:41:48,166 --> 00:41:50,700

And we started to learn
all about the properties

864

00:41:50,700 --> 00:41:51,833

of these gases.

865

00:41:51,833 --> 00:41:54,133

And we even went so far
as to fill up

866

00:41:54,133 --> 00:41:55,666

a couple of the smaller
wind tunnels

867

00:41:55,666 --> 00:41:59,966

with carbon dioxide
and nitrogen gas mixtures

868

00:41:59,966 --> 00:42:03,600

to try to see what--
you know,

869

00:42:03,600 --> 00:42:07,466

compare what we measured
with what we had calculated.

870

00:42:11,666 --> 00:42:13,800

After the beginning
of NASA, of course,

871

00:42:13,800 --> 00:42:16,266

there was a big frenzy
to build a whole bunch

872

00:42:16,266 --> 00:42:17,933

of new facilities.

873

00:42:17,933 --> 00:42:21,266

And the 3 1/2 foot
hypersonic wind tunnel

874

00:42:21,266 --> 00:42:24,200

came along and was built.

875

00:42:24,200 --> 00:42:28,400

The arc jet complex
for the high-speed materials,

876

00:42:28,400 --> 00:42:31,233

high testing work came along.

877

00:42:31,233 --> 00:42:34,833

And we had a lot of work
on shock tubes development.

878

00:42:34,833 --> 00:42:39,400

And the ballistics ranges--

new ballistics ranges

879

00:42:39,400 --> 00:42:42,233

were put into force

where you could fire models

880

00:42:42,233 --> 00:42:46,166

at hypersonic speeds

in the range

881

00:42:46,166 --> 00:42:50,733

and measure its performance

as it flew along.

882

00:42:50,733 --> 00:42:53,433

So a lot of new facilities.

883

00:42:53,433 --> 00:42:55,333

We went from--

884

00:42:55,333 --> 00:42:59,533

That NACA was a few thousand
people in '58.

885

00:42:59,533 --> 00:43:02,666

And at the peak of NASA,
there were 400,000 people

886

00:43:02,666 --> 00:43:04,533

on the NASA payroll.

887

00:43:04,533 --> 00:43:08,166

So it was quite an expansion
from a couple thousand

888

00:43:08,166 --> 00:43:12,366

to 400,000 at the peak.

889

00:43:12,366 --> 00:43:15,433

It was interesting,
and that's--

890
00:43:15,433 --> 00:43:17,700
When NASA came along
is when we could finally

891
00:43:17,700 --> 00:43:22,300
start to go to technical
meetings and present our work

892
00:43:22,300 --> 00:43:23,600
on the outside.

893
00:43:23,600 --> 00:43:26,833
Prior to that,
at Ames, before NASA,

894
00:43:26,833 --> 00:43:29,700
it was even difficult
to make a phone call

895
00:43:29,700 --> 00:43:31,666
outside the base.

896
00:43:31,666 --> 00:43:35,900
In the 6x6 foot wind tunnel,
we had two phones:

897
00:43:35,900 --> 00:43:37,833
one in the hallway
on the first floor,

898
00:43:37,833 --> 00:43:40,366
one in the hallway
on the second floor.

899
00:43:40,366 --> 00:43:43,500
And if you received a call
or wanted to make a call,

900

00:43:43,500 --> 00:43:46,766

you had to go out to the hall,
stand in the hall and talk.

901

00:43:46,766 --> 00:43:49,300

And you couldn't call
off-center

902

00:43:49,300 --> 00:43:53,333

without going through
the center's operator.

903

00:43:53,333 --> 00:43:55,366

There was an operator
that handled

904

00:43:55,366 --> 00:44:00,200

all the phone transmissions
in and out of the center.

905

00:44:00,200 --> 00:44:04,133

So transferring information
was a little tedious.

906

00:44:04,133 --> 00:44:07,266

And that's--it was really
all done through the reports.

907

00:44:07,266 --> 00:44:09,200

You write the reports,
and they were published,

908

00:44:09,200 --> 00:44:11,866

and people read them, hopefully.

909

00:44:11,866 --> 00:44:15,733

At that time, my work started
to shift from

910
00:44:15,733 --> 00:44:20,666
then aerodynamics
in the Earth's atmosphere

911
00:44:20,666 --> 00:44:23,366
to aerodynamics
in the atmospheres

912
00:44:23,366 --> 00:44:27,333
of like Mars and Venus
and that sort of thing.

913
00:44:27,333 --> 00:44:32,633
And I got also interested
in the motions of vehicles

914
00:44:32,633 --> 00:44:35,933
flying at high speeds
in these other atmospheres.

915
00:44:35,933 --> 00:44:40,133
And did a lot of work on
what happens if you have

916
00:44:40,133 --> 00:44:42,833
a planetary probe type
vehicle,

917
00:44:42,833 --> 00:44:45,233
and you just threw it into
an atmosphere,

918
00:44:45,233 --> 00:44:47,633
tumbling in a random way.

919
00:44:47,633 --> 00:44:50,266
Would it straighten out,
get nose first--

920

00:44:50,266 --> 00:44:55,266
heat shield first,
and then go on down through

921
00:44:55,266 --> 00:44:57,866
and make a successful entry?

922
00:44:57,866 --> 00:44:59,800
So I studied
the tumbling bodies.

923
00:44:59,800 --> 00:45:03,333
And that brought on the use
of large-scale

924
00:45:03,333 --> 00:45:05,966
computer programs,
because when you're solving

925
00:45:05,966 --> 00:45:08,333
the Six Degree of Freedoms

926
00:45:08,333 --> 00:45:10,233
equation of motion,
you can't do it

927
00:45:10,233 --> 00:45:11,300
with paper and pencil.

928
00:45:11,300 --> 00:45:13,233
You have to do it
on a computer.

929
00:45:13,233 --> 00:45:16,733
And the first computer at Ames,
was the--real computer

930
00:45:16,733 --> 00:45:19,233
was the IBM 650.

931
00:45:19,233 --> 00:45:22,200
And you'd write up
your equations.

932
00:45:22,200 --> 00:45:27,166
The girls would punch in
the equations in punch cards.

933
00:45:27,166 --> 00:45:30,866
You'd send the punch cards
over to the computer.

934
00:45:30,866 --> 00:45:34,066
The program ran so long
it would take all night long.

935
00:45:34,066 --> 00:45:35,533
They wouldn't run it
during the day

936
00:45:35,533 --> 00:45:37,400
because it tied up
the whole machine

937
00:45:37,400 --> 00:45:40,400
for eight or ten hours.

938
00:45:40,400 --> 00:45:42,700
So I'd get a case ready to go,
send it over.

939
00:45:42,700 --> 00:45:44,666
They'd run it
through the machine.

940
00:45:44,666 --> 00:45:48,000
Next day, they would come back,
the answers would be a mistake.

941

00:45:48,000 --> 00:45:51,066

So you'd go back through
and you'd find out

942

00:45:51,066 --> 00:45:52,733

where the problem was,
re-punch the card,

943

00:45:52,733 --> 00:45:53,966

send it back over.

944

00:45:53,966 --> 00:45:56,433

And you went through this
cycle a number of times.

945

00:45:56,433 --> 00:45:59,533

So that was kind of fun.

946

00:45:59,533 --> 00:46:02,800

So today,

947

00:46:02,800 --> 00:46:05,700

there's quite a world
of difference

948

00:46:05,700 --> 00:46:09,066

between what it was like
to work with NACA

949

00:46:09,066 --> 00:46:11,466

in the '50s and early '60s.

950

00:46:11,466 --> 00:46:14,733

And now, of course, if somebody
asks you where you work

951

00:46:14,733 --> 00:46:17,400

and you say you work for NASA,
everybody knows.

952

00:46:17,400 --> 00:46:19,633

They'd say you're
a rocket scientist.

953

00:46:19,633 --> 00:46:24,900

And they didn't know
what NACA was in my day.

954

00:46:24,900 --> 00:46:28,200

I think NACA laid
the foundation

955

00:46:28,200 --> 00:46:33,100

for a lot of the culture
that's in NASA today

956

00:46:33,100 --> 00:46:37,566

in terms of very careful work,

957

00:46:37,566 --> 00:46:41,233

you know, making sure
everything was right

958

00:46:41,233 --> 00:46:43,100

before you published it.

959

00:46:43,100 --> 00:46:47,500

And when we were going on
into the space program,

960

00:46:47,500 --> 00:46:49,066

you couldn't afford
any mistakes.

961

00:46:49,066 --> 00:46:52,566

And so I think
the early culture of NACA

962

00:46:52,566 --> 00:46:56,433

of doing meticulous research
and meticulous checking

963

00:46:56,433 --> 00:46:59,400

of everything helped to make
the space program

964

00:46:59,400 --> 00:47:02,033

as successful as it has been.

965

00:47:02,033 --> 00:47:03,833

Thank you.

966

00:47:03,833 --> 00:47:06,833

[applause]

967

00:47:11,666 --> 00:47:12,933

- Thank you very much, Vic.

968

00:47:12,933 --> 00:47:16,133

We'll have time for just
one or two questions.

969

00:47:16,133 --> 00:47:19,133

But let me start
with a question.

970

00:47:19,133 --> 00:47:21,666

And that is,

971

00:47:21,666 --> 00:47:24,500

did the NACA miss space?

972

00:47:24,500 --> 00:47:27,033

Were you so focused
on the work that you were

973

00:47:27,033 --> 00:47:30,700

doing in aerodynamics,

that by 1958,

974

00:47:30,700 --> 00:47:33,900
the NACA did not have any work
going in the space program?

975

00:47:33,900 --> 00:47:38,333
Or had you anticipated
that the aerospace regime

976

00:47:38,333 --> 00:47:42,000
would expand from
the atmosphere into space?

977

00:47:42,000 --> 00:47:46,066
- I think there was some
anticipation of it.

978

00:47:46,066 --> 00:47:49,233
As I recall, before NASA
was officially formed,

979

00:47:49,233 --> 00:47:52,100
there were some groups
formed called,

980

00:47:52,100 --> 00:47:54,200
I think, space task groups?

981

00:47:54,200 --> 00:47:56,400
- Space task groups.
- Space task groups.

982

00:47:56,400 --> 00:48:00,066
And select people
from Ames, Langley, and Lewis,

983

00:48:00,066 --> 00:48:02,633
and probably
the flight center

984

00:48:02,633 --> 00:48:03,866
were put together.

985

00:48:03,866 --> 00:48:07,500
And they started to do
the advanced thinking

986

00:48:07,500 --> 00:48:10,466
about, you know,
how should we start?

987

00:48:10,466 --> 00:48:13,000
The president, by that time,
had said we have

988

00:48:13,000 --> 00:48:15,400
to go to the moon
in this decade.

989

00:48:15,400 --> 00:48:19,066
So that set--
those were the marching orders.

990

00:48:19,066 --> 00:48:22,766
And this space task group
then met with--

991

00:48:22,766 --> 00:48:25,366
largely, in different
disciplines.

992

00:48:25,366 --> 00:48:27,533
And the structures,
people would talk about,

993

00:48:27,533 --> 00:48:28,833
what do they have to do?

994

00:48:28,833 --> 00:48:31,866

The aero people, what do they--
the heating people, etc.

995

00:48:31,866 --> 00:48:35,966

So there was a build up,
maybe starting,

996

00:48:35,966 --> 00:48:39,000

I'd say, I don't know,
a year before NASA.

997

00:48:39,000 --> 00:48:41,566

- I think--in response to that,
I think in the early '50s,

998

00:48:41,566 --> 00:48:45,133

Harvey Allen got it started,
thinking about going into space

999

00:48:45,133 --> 00:48:46,800

with his blunt body concept.

1000

00:48:46,800 --> 00:48:48,933

So we were thinking,
five, six years before

1001

00:48:48,933 --> 00:48:50,300

we became NASA,

1002

00:48:50,300 --> 00:48:53,233

if we were gonna be
going out there, actually.

1003

00:48:53,233 --> 00:48:54,766

And one other comment
I want to make.

1004

00:48:54,766 --> 00:48:57,900

Vic made a good point

of things we did and didn't do.

1005

00:48:57,900 --> 00:49:00,333

I'll quit after this.

1006

00:49:00,333 --> 00:49:03,366

You know the famous saying
in the space group

1007

00:49:03,366 --> 00:49:05,933

that failure is not an option?

1008

00:49:05,933 --> 00:49:08,166

Well, in developing technology
of any kind,

1009

00:49:08,166 --> 00:49:11,300

and doing science,
failure is an option.

1010

00:49:11,300 --> 00:49:12,566

Because you take risk.

1011

00:49:12,566 --> 00:49:14,866

If you don't take risk,
you don't get anywhere.

1012

00:49:14,866 --> 00:49:16,833

It's true you don't take it
with human life,

1013

00:49:16,833 --> 00:49:19,166

but you sure as hell do
in technology.

1014

00:49:19,166 --> 00:49:20,766

You take risks.

1015

00:49:20,766 --> 00:49:23,800

So you guys should do that--
think about that, anyway.

1016
00:49:23,800 --> 00:49:25,466
That's it.

1017
00:49:25,466 --> 00:49:27,766
- Okay, and now, if anybody
from the audience

1018
00:49:27,766 --> 00:49:29,666
would like to move
to the microphone

1019
00:49:29,666 --> 00:49:32,366
and ask their own question.

1020
00:49:32,366 --> 00:49:35,900
And while we're waiting,
let me say that I'm glad

1021
00:49:35,900 --> 00:49:38,266
that both of--all three of you
talked about

1022
00:49:38,266 --> 00:49:41,333
the importance of communication,
about the inspections,

1023
00:49:41,333 --> 00:49:45,033
and about the NACA
publication program,

1024
00:49:45,033 --> 00:49:48,000
which really was very unique
and different from how

1025
00:49:48,000 --> 00:49:50,333
NASA people today
present their work.

1026

00:49:50,333 --> 00:49:53,733

But let me ask you a little bit
about two leaders here,

1027

00:49:53,733 --> 00:49:57,066

Harvey Allen and Smith DeFrance.

1028

00:49:57,066 --> 00:50:00,266

DeFrance was Center Director
for 25 years, until 1965.

1029

00:50:00,266 --> 00:50:02,700

Harvey Allen worked here
until 1970.

1030

00:50:02,700 --> 00:50:07,033

What impact did they have
on the NACA?

1031

00:50:07,033 --> 00:50:08,266

Jack, why don't you start and--

1032

00:50:08,266 --> 00:50:10,300

- Well, Smithy was a constru--
he built Ames.

1033

00:50:10,300 --> 00:50:12,833

He built wind tunnels.
He built arc jets.

1034

00:50:12,833 --> 00:50:14,666

He was here for 25 years.

1035

00:50:14,666 --> 00:50:18,000

And that was his main goal
in life, to build things.

1036

00:50:18,000 --> 00:50:20,733

And he was very good at it,
'cause they taught him

1037
00:50:20,733 --> 00:50:23,000
at Langley Field.

1038
00:50:23,000 --> 00:50:26,866
So--who else?

1039
00:50:26,866 --> 00:50:28,866
- Harvey Allen
and Smith DeFrance.

1040
00:50:28,866 --> 00:50:32,233
- Well, Harvey was influential,
I think, around the world

1041
00:50:32,233 --> 00:50:33,733
in the research he did.

1042
00:50:33,733 --> 00:50:36,166
Nobody wanted to think
of this blunt body

1043
00:50:36,166 --> 00:50:38,066
as a concept that would be
valuable in space,

1044
00:50:38,066 --> 00:50:39,533
except he did.

1045
00:50:39,533 --> 00:50:43,400
And he had the support of some
of the folks like astronomers.

1046
00:50:43,400 --> 00:50:45,233
Fred Whipple
was an astronomer.

1047

00:50:45,233 --> 00:50:46,900

And they would view
what happened

1048

00:50:46,900 --> 00:50:50,033

to these vehicles, the asteroids
that came into Earth.

1049

00:50:50,033 --> 00:50:51,966

And they found a lot
of the pieces were blunt,

1050

00:50:51,966 --> 00:50:53,233

blunt shapes.

1051

00:50:53,233 --> 00:50:55,733

He figured, you know,
intuitively, why is that?

1052

00:50:55,733 --> 00:50:57,833

And he worked back
and got the aerodynamics

1053

00:50:57,833 --> 00:50:59,100

worked out right.

1054

00:50:59,100 --> 00:51:00,500

And that's how he got
his blunt shape

1055

00:51:00,500 --> 00:51:03,333

and affected enormously
around the world,

1056

00:51:03,333 --> 00:51:05,300

I think, space exploration.

1057

00:51:05,300 --> 00:51:08,266

You got a question back there.

1058

00:51:08,266 --> 00:51:11,700

- So, I guess, one thing
that kind of is--

1059

00:51:11,700 --> 00:51:14,500

If you had one thing
that you could transplant

1060

00:51:14,500 --> 00:51:16,300

that you had in the NACA
that you think

1061

00:51:16,300 --> 00:51:19,466

is missing from
the NASA culture today,

1062

00:51:19,466 --> 00:51:21,800

what is that one thing
that you would, you know,

1063

00:51:21,800 --> 00:51:24,166

transplant from NACA to NASA?

1064

00:51:24,166 --> 00:51:28,433

- The ability to take risks
in research and technology.

1065

00:51:28,433 --> 00:51:29,766

You know, we have--

1066

00:51:29,766 --> 00:51:32,266

This is being recorded,
isn't it?

1067

00:51:32,266 --> 00:51:34,466

I better be careful.

1068

00:51:34,466 --> 00:51:37,833

We have so many constraints

sometimes from different places

1069

00:51:37,833 --> 00:51:40,033

and different folks,
that you're afraid

1070

00:51:40,033 --> 00:51:42,133

to take risks as they are.

1071

00:51:42,133 --> 00:51:43,766

And I think that goes
all the way through

1072

00:51:43,766 --> 00:51:46,433

the ranks back to Congress.

1073

00:51:46,433 --> 00:51:47,933

They don't want failure.

1074

00:51:47,933 --> 00:51:50,333

They just can't accept failure.

1075

00:51:50,333 --> 00:51:52,666

And you've got to accept
some risks like that.

1076

00:51:52,666 --> 00:51:56,333

I would take that as a point
we should keep in mind

1077

00:51:56,333 --> 00:51:59,333

as you guys go along
in your careers.

1078

00:51:59,333 --> 00:52:03,600

Vic?

1079

00:52:03,600 --> 00:52:05,333

Where'd he go?

1080

00:52:05,333 --> 00:52:07,466

- Okay.

1081

00:52:07,466 --> 00:52:09,433

Okay, Jonas.

1082

00:52:09,433 --> 00:52:10,766

- Is there somebody else?

1083

00:52:10,766 --> 00:52:16,566

Oh, I got a phone-in message,
basically, a question.

1084

00:52:16,566 --> 00:52:18,766

Question is from
John Livacich.

1085

00:52:18,766 --> 00:52:24,033

And he was wondering about
a Japanese Zero

1086

00:52:24,033 --> 00:52:27,466

that was captured
in Alaska during World War II.

1087

00:52:27,466 --> 00:52:28,733

And he was wondering
whether or not

1088

00:52:28,733 --> 00:52:32,600

it was actually tested
here at Ames.

1089

00:52:32,600 --> 00:52:35,233

- I'm sorry, a Japanese what?
- Japanese Zero.

1090

00:52:35,233 --> 00:52:37,366

- Zero, an airplane.
- The aircraft.

1091
00:52:37,366 --> 00:52:38,633
- Yeah, what about it, now?

1092
00:52:38,633 --> 00:52:41,666
- Was there one tested here?

1093
00:52:41,666 --> 00:52:43,666
Was one tested here?

1094
00:52:43,666 --> 00:52:45,833
Was it brought over to Ames?

1095
00:52:45,833 --> 00:52:47,300
- Not to my knowledge,
it wasn't.

1096
00:52:47,300 --> 00:52:48,800
- If you gentlemen
don't remember,

1097
00:52:48,800 --> 00:52:50,266
I'm sure we've got something
written in the archive

1098
00:52:50,266 --> 00:52:53,533
where we can answer John's
question if he contacts us.

1099
00:52:53,533 --> 00:52:54,633
- Thank you.

1100
00:52:54,633 --> 00:52:57,100
- Okay, last question.

1101
00:52:57,100 --> 00:53:00,833
- So in considering

the formation of NASA,

1102

00:53:00,833 --> 00:53:02,733

I always had the notion
that there were

1103

00:53:02,733 --> 00:53:04,800

four organizations
that were part of that.

1104

00:53:04,800 --> 00:53:07,033

And you've represented
the four NACA centers.

1105

00:53:07,033 --> 00:53:10,633

But I always thought that
significant representation

1106

00:53:10,633 --> 00:53:13,933

from Goddard's rocketry program

1107

00:53:13,933 --> 00:53:18,600

and from the Redstone Arsenal
work that Werner von Braun

1108

00:53:18,600 --> 00:53:20,933

had been doing,
as well as some Air Force work

1109

00:53:20,933 --> 00:53:24,200

down at Dryden--

1110

00:53:24,200 --> 00:53:26,666

well, down in the
Edwards Air Force Base

1111

00:53:26,666 --> 00:53:29,100

were other organizations
that got rolled up

1112
00:53:29,100 --> 00:53:32,266
into the NASA entity.

1113
00:53:32,266 --> 00:53:35,100
And so my question to you is,
first of all, is that true?

1114
00:53:35,100 --> 00:53:38,200
And second, how much
of that heritage

1115
00:53:38,200 --> 00:53:40,800
actually made it into
NASA as well?

1116
00:53:40,800 --> 00:53:46,433
You know, as I work with
the range organizations--

1117
00:53:46,433 --> 00:53:48,566
and I think of those
as Dryden and Wallops--

1118
00:53:48,566 --> 00:53:50,700
there seems to be quite
a different philosophy,

1119
00:53:50,700 --> 00:53:53,800
a more rocketry-oriented
philosophy in those guys

1120
00:53:53,800 --> 00:53:55,700
than we see in a lot
of the other centers.

1121
00:53:55,700 --> 00:53:58,000
- The base in Marshall,
Marshall being

1122

00:53:58,000 --> 00:53:59,866

where the rockets
were being built,

1123

00:53:59,866 --> 00:54:02,100

got rolled into NASA.

1124

00:54:02,100 --> 00:54:06,033

And, in a sense, JPL got rolled
into NASA eventually,

1125

00:54:06,033 --> 00:54:08,333

you know, a bit later
than the others.

1126

00:54:08,333 --> 00:54:10,833

So--and the JPL folks
had been focusing

1127

00:54:10,833 --> 00:54:14,600

on military activities
of various kinds.

1128

00:54:14,600 --> 00:54:16,300

Those are the two
that I know of

1129

00:54:16,300 --> 00:54:19,066

got rolled into NASA.

1130

00:54:19,066 --> 00:54:21,366

There may be others.

1131

00:54:21,366 --> 00:54:23,433

- You mentioned Goddard.

1132

00:54:23,433 --> 00:54:26,366

Goddard Space Flight Center
wasn't created

1133

00:54:26,366 --> 00:54:30,600

until well after

NASA was created.

1134

00:54:30,600 --> 00:54:33,066

- I was thinking more of

Goddard the rocket scientist

1135

00:54:33,066 --> 00:54:34,433

and his work.

1136

00:54:34,433 --> 00:54:36,166

Did that all get captured

in the NASA organization?

1137

00:54:36,166 --> 00:54:38,333

- Well, that came in

through von Braun.

1138

00:54:38,333 --> 00:54:39,466

- Through von Braun.

1139

00:54:39,466 --> 00:54:43,233

- Werner von Braun and his group

of, what was it,

1140

00:54:43,233 --> 00:54:46,400

20 or 30 people were brought

over from Germany

1141

00:54:46,400 --> 00:54:49,500

after the war.

1142

00:54:49,500 --> 00:54:55,066

And they became the nucleus

of the Marshall Center.

1143

00:54:55,066 --> 00:54:57,533

- And I think a piece

of the Navy vanguard activity

1144

00:54:57,533 --> 00:54:59,300
got rolled into it as well.

1145

00:54:59,300 --> 00:55:01,033
- The Navy activity.
- Yeah.

1146

00:55:01,033 --> 00:55:04,400
- But NACA had the predominance
of the workforce.

1147

00:55:04,400 --> 00:55:06,033
And so NACA owned
the prominence--

1148

00:55:06,033 --> 00:55:08,200
the predominance of the culture.

1149

00:55:08,200 --> 00:55:09,633
- Yeah.

1150

00:55:09,633 --> 00:55:12,733
Incidentally, you should never
say "naca" to a NACA person.

1151

00:55:12,733 --> 00:55:13,833
[all laughing]

1152

00:55:13,833 --> 00:55:16,466
'Cause at Langley Field,
they used to be

1153

00:55:16,466 --> 00:55:20,866
called the "naca nuts,"
you know, around the community.

1154

00:55:20,866 --> 00:55:22,366

- Well, thank you all
for listening.

1155

00:55:22,366 --> 00:55:25,666

And thank you, Walter and Jack
and Vic, for speaking with us.

1156

00:55:25,666 --> 00:55:28,666

[applause]