



1
00:00:26,689 --> 00:00:22,540
what might look like a step backwards is

2
00:00:34,040 --> 00:00:26,699
actually two giant steps forward on the

3
00:00:39,750 --> 00:00:38,040
since 1941 the Lewis Research Center has

4
00:00:42,060 --> 00:00:39,760
developed an international reputation

5
00:00:46,799 --> 00:00:42,070
for its research on jet propulsion

6
00:00:49,229 --> 00:00:46,809
systems however in 1977 the researchers

7
00:00:51,990 --> 00:00:49,239
at Louis began to take a new look at the

8
00:00:54,360 --> 00:00:52,000
propeller their challenge was to combine

9
00:00:56,880 --> 00:00:54,370
the efficiency of the propeller with the

10
00:01:00,630 --> 00:00:56,890
power of the turbine engine what has

11
00:01:01,579 --> 00:01:00,640
evolved is ATP the advanced turboprop

12
00:01:04,350 --> 00:01:01,589
project

13
00:01:07,020 --> 00:01:04,360

Keith severs manager of the NASA

14

00:01:09,480 --> 00:01:07,030

advanced turboprop project office at the

15

00:01:12,600 --> 00:01:09,490

Lewis Research Center back after World

16

00:01:14,820 --> 00:01:12,610

War two jets for the thing the coming

17

00:01:17,430 --> 00:01:14,830

thing her powers were very efficient in

18

00:01:20,430 --> 00:01:17,440

those days but they couldn't go fast it

19

00:01:23,040 --> 00:01:20,440

couldn't go to high altitudes and quite

20

00:01:24,960 --> 00:01:23,050

frankly they were not jazzy like jet

21

00:01:27,060 --> 00:01:24,970

engines and which gave way them to

22

00:01:29,940 --> 00:01:27,070

turbofan engines and high bypass ratio

23

00:01:31,919 --> 00:01:29,950

engines and when fuel was cheap people

24

00:01:34,499 --> 00:01:31,929

didn't worry much about it 10 cents a

25

00:01:36,899 --> 00:01:34,509

gallon as long as they get speed high

26

00:01:39,359 --> 00:01:36,909

altitude capability which the air

27

00:01:42,240 --> 00:01:39,369

transport system required propellers

28

00:01:45,510 --> 00:01:42,250

just kind of withered on the vine for 20

29

00:01:47,819 --> 00:01:45,520

or 30 years the Arab oil embargo of the

30

00:01:50,340 --> 00:01:47,829

early 70s not only hit American

31

00:01:52,620 --> 00:01:50,350

consumers at the corner gas station but

32

00:01:54,990 --> 00:01:52,630

was also reflected at the airline ticket

33

00:01:59,550 --> 00:01:55,000

counter due to the soaring price of jet

34

00:02:02,370 --> 00:01:59,560

fuel in 1973 the price of a gallon of

35

00:02:04,590 --> 00:02:02,380

jet fuel was 12 cents and represented

36

00:02:08,310 --> 00:02:04,600

one-quarter of the direct operating cost

37

00:02:11,699 --> 00:02:08,320

of the jet by 1979 the price had risen

38

00:02:14,310 --> 00:02:11,709

to 63 cents a gallon and represented

39

00:02:17,759 --> 00:02:14,320

half of the direct operating cost in

40

00:02:20,490 --> 00:02:17,769

1981 the cost of jet fuel was over a

41

00:02:23,310 --> 00:02:20,500

dollar eight cents a gallon with the

42

00:02:25,530 --> 00:02:23,320

rising fuel prices a fuel efficient

43

00:02:27,660 --> 00:02:25,540

propeller engine again became the object

44

00:02:31,199 --> 00:02:27,670

of an aeronautical propulsion research

45

00:02:34,470 --> 00:02:31,209

effort the researchers objectives were

46

00:02:38,780 --> 00:02:34,480

to develop a powerplant that would be

47

00:02:44,129 --> 00:02:38,790

fuel efficient dew point eight mach

48

00:02:45,990 --> 00:02:44,139

cruise at 35,000 feet operate at a

49

00:02:47,640 --> 00:02:46,000

reduced noise level

50

00:02:49,200 --> 00:02:47,650

these propellers look a lot different

51
00:02:51,480 --> 00:02:49,210
there are very highly swept they're very

52
00:02:53,490 --> 00:02:51,490
thin compared to old propellers and the

53
00:02:56,430 --> 00:02:53,500
thing it hits you first is they're eight

54
00:02:57,960 --> 00:02:56,440
to ten blades on these are rather than

55
00:03:00,840 --> 00:02:57,970
three or four is that you've been

56
00:03:02,760 --> 00:03:00,850
accustomed to in the past and what the

57
00:03:05,430 --> 00:03:02,770
sweep doesn't in the propeller end of

58
00:03:07,080 --> 00:03:05,440
finis is is to reduce the drag losses at

59
00:03:09,420 --> 00:03:07,090
the higher tip speeds and higher Mach

60
00:03:12,870 --> 00:03:09,430
numbers also helps to reduce the source

61
00:03:14,790 --> 00:03:12,880
noise of the propellers the higher blade

62
00:03:17,070 --> 00:03:14,800
count and we've loaded these blades up

63
00:03:18,870 --> 00:03:17,080

much higher than old propellers so we

64

00:03:21,540 --> 00:03:18,880

get a lot more power at a lot smaller

65

00:03:23,490 --> 00:03:21,550

diameter and this saves weight on the

66

00:03:25,979 --> 00:03:23,500

propeller say it's weight on the engine

67

00:03:28,800 --> 00:03:25,989

and it also packages better on the

68

00:03:33,570 --> 00:03:28,810

aircraft earlier two turbo props were

69

00:03:36,420 --> 00:03:33,580

limited both in horsepower and in flight

70

00:03:38,940 --> 00:03:36,430

speed mainly because of the

71

00:03:44,220 --> 00:03:38,950

compressibility effects that occur at

72

00:03:46,770 --> 00:03:44,230

the propeller tips with the recent

73

00:03:49,290 --> 00:03:46,780

advances in computer design technology

74

00:03:52,289 --> 00:03:49,300

we are now able to optimize the blade

75

00:03:54,680 --> 00:03:52,299

shape to minimize the compressibility

76

00:03:57,900 --> 00:03:54,690

effects occurring at the blade tips

77

00:04:01,199 --> 00:03:57,910

allowing the planes to fly faster up to

78

00:04:04,680 --> 00:04:01,209

six hundred miles an hour and at higher

79

00:04:08,789 --> 00:04:04,690

altitudes up to 35,000 feet as you

80

00:04:11,400 --> 00:04:08,799

approach the speed of sound you run into

81

00:04:13,500 --> 00:04:11,410

a problem where the apparent pressure

82

00:04:17,090 --> 00:04:13,510

that you're trying to push through

83

00:04:20,699 --> 00:04:17,100

suddenly takes a quantum leap and

84

00:04:25,230 --> 00:04:20,709

because the blades are very large in

85

00:04:30,030 --> 00:04:25,240

diameter to 13 feet in diameter the tip

86

00:04:34,950 --> 00:04:30,040

speed is upwards of 800 feet per second

87

00:04:37,110 --> 00:04:34,960

which is just under Mach 1 or the speed

88

00:04:41,130 --> 00:04:37,120

of sound as you try to push through that

89

00:04:43,380 --> 00:04:41,140

Mach 1 range you run into this

90

00:04:45,240 --> 00:04:43,390

compressibility factor it's almost like

91

00:04:47,490 --> 00:04:45,250

running into a brick wall with the blade

92

00:04:49,620 --> 00:04:47,500

the blade construction is now a

93

00:04:52,020 --> 00:04:49,630

composite type arrangement where you

94

00:04:54,930 --> 00:04:52,030

have a metallic leading edge such as

95

00:04:57,180 --> 00:04:54,940

aluminum and a graphite epoxy resin'd

96

00:04:59,559 --> 00:04:57,190

internal construction that allows the

97

00:05:01,779 --> 00:04:59,569

blades to be very lightweight and

98

00:05:03,820 --> 00:05:01,789

cause they're lighter weight minimizes

99

00:05:05,709 --> 00:05:03,830

the centrifugal stresses that occur when

100

00:05:09,239 --> 00:05:05,719

the propeller system is rotated at

101
00:05:11,889 --> 00:05:09,249
12,000 rpm ultimate goal is to save fuel

102
00:05:15,159 --> 00:05:11,899
commercial aircraft and also military

103
00:05:17,290 --> 00:05:15,169
aircraft were it can be applied and this

104
00:05:20,070 --> 00:05:17,300
fuel saving is very dramatic compared to

105
00:05:24,059 --> 00:05:20,080
the fuel burn that aircraft have today

106
00:05:27,609 --> 00:05:24,069
such as a 727 737 that type of air cream

107
00:05:30,219 --> 00:05:27,619
aircraft a prop van driven airplane can

108
00:05:32,199 --> 00:05:30,229
do the same mission that like forty to

109
00:05:35,790 --> 00:05:32,209
fifty percent of the fuel that they use

110
00:05:38,980 --> 00:05:35,800
today if you look at just the u.s. fleet

111
00:05:42,909 --> 00:05:38,990
existing today for medium to short range

112
00:05:46,269 --> 00:05:42,919
aircraft I'm talking 727 737 is dc-9s

113
00:05:49,510 --> 00:05:46,279

md-80s those aircraft in a typical year

114

00:05:52,989 --> 00:05:49,520

burn about 5 billion gallons of fuel if

115

00:05:54,879 --> 00:05:52,999

these aircrafts were equipped with pop

116

00:05:57,279 --> 00:05:54,889

fans they could do the same mission

117

00:05:58,749 --> 00:05:57,289

they're doing today and save two to two

118

00:06:08,309 --> 00:05:58,759

and a half billion gallons of fuel per

119

00:06:12,629 --> 00:06:10,379

propeller-driven airplanes have

120

00:06:15,149 --> 00:06:12,639

traditionally been noisy advanced

121

00:06:16,920 --> 00:06:15,159

turboprop researchers are tackling the

122

00:06:19,559 --> 00:06:16,930

problem of trying to build a turboprop

123

00:06:22,950 --> 00:06:19,569

to rival the relative quiet and

124

00:06:24,959 --> 00:06:22,960

smoothness of the ship well we've had to

125

00:06:26,670 --> 00:06:24,969

look at the entire aircraft as a system

126

00:06:29,219 --> 00:06:26,680

we didn't look just at sticking a new

127

00:06:30,839 --> 00:06:29,229

widget called a prop fan on them better

128

00:06:32,999 --> 00:06:30,849

look at what to do they do to the rest

129

00:06:35,219 --> 00:06:33,009

of the aircraft and particularly we're

130

00:06:37,049 --> 00:06:35,229

concerned about passenger comfort it

131

00:06:39,570 --> 00:06:37,059

doesn't matter how much fuel was saved

132

00:06:43,049 --> 00:06:39,580

if people don't like it or they're

133

00:06:44,070 --> 00:06:43,059

uncomfortable sound vibration and

134

00:06:46,350 --> 00:06:44,080

they're not going to write it so it

135

00:06:49,079 --> 00:06:46,360

won't matter so part of our project goal

136

00:06:50,549 --> 00:06:49,089

is to to make sure that people have the

137

00:06:53,239 --> 00:06:50,559

same comfort that they're used to on

138

00:06:55,499 --> 00:06:53,249

today's wide-body aircraft in addition

139

00:06:57,209 --> 00:06:55,509

we're concerned about community noise

140

00:06:58,739 --> 00:06:57,219

these things are allowed and we have to

141

00:07:01,529 --> 00:06:58,749

provide the technology sort of the

142

00:07:04,740 --> 00:07:01,539

equivalent existing far 36-yard stage

143

00:07:04,740 --> 00:07:04,750

three regulate

144

00:07:04,750 --> 00:07:18,680

by around airports and communities

145

00:07:22,620 --> 00:07:20,879

most the time we really don't even know

146

00:07:25,409 --> 00:07:22,630

what's running inside the cockpit it's

147

00:07:27,930 --> 00:07:25,419

that quiet and we're only what 15 feet

148

00:07:30,689 --> 00:07:27,940

away from after several years of wind

149

00:07:32,580 --> 00:07:30,699

tunnel and static engine testing a full

150

00:07:36,210 --> 00:07:32,590

flight test of the advanced propeller

151

00:07:38,850 --> 00:07:36,220

system was held on May 19 1987 at

152

00:07:41,610 --> 00:07:38,860

Lockheed Georgia company in Marietta

153

00:07:44,700 --> 00:07:41,620

Georgia so far operation has been very

154

00:07:47,820 --> 00:07:44,710

good everything is about as predicted

155

00:07:49,520 --> 00:07:47,830

that the engineers had predicted from

156

00:07:51,990 --> 00:07:49,530

their initial assessment of the program

157

00:07:56,010 --> 00:07:52,000

we haven't really had any big surprises

158

00:07:58,980 --> 00:07:56,020

I should say when you pull the prop fan

159

00:08:01,230 --> 00:07:58,990

in and add power to it the pilot really

160

00:08:02,939 --> 00:08:01,240

knows it but there again this airplane

161

00:08:05,969 --> 00:08:02,949

wasn't really designed to fly with an

162

00:08:08,879 --> 00:08:05,979

engine out on a on the left wing but

163

00:08:09,960 --> 00:08:08,889

again what our engineers predicted is

164

00:08:12,029 --> 00:08:09,970

pretty much what's happening with the

165

00:08:14,640 --> 00:08:12,039

airplane so I'd have to say so far it

166

00:08:17,279 --> 00:08:14,650

looks good so far it looks very good if

167

00:08:19,560 --> 00:08:17,289

all goes to plan prop fans will probably

168

00:08:22,980 --> 00:08:19,570

be fitted on short to medium range

169

00:08:25,650 --> 00:08:22,990

aircraft we hope to have as a part of

170

00:08:29,010 --> 00:08:25,660

the project goal to have a technology in

171

00:08:31,770 --> 00:08:29,020

hand by the end of 1980s so that

172

00:08:33,540 --> 00:08:31,780

industry the engine people the aircraft

173

00:08:36,510 --> 00:08:33,550

people can make marketing decisions

174

00:08:39,000 --> 00:08:36,520

because it involves a lot of private

175

00:08:42,079 --> 00:08:39,010

capital that's a make sure breaks our

176

00:08:45,600 --> 00:08:42,089

company so the way things are proceeding

177

00:08:48,060 --> 00:08:45,610

right now it looks like Boeing and

178

00:08:50,310 --> 00:08:48,070

McDonnell Douglas are aiming for new