



1
00:00:00,000 --> 00:00:14,060
Music ■

2
00:00:14,060 --> 00:00:17,090
Rising out of the flat
desert sands in Edwards,

3
00:00:17,090 --> 00:00:21,087
CA is a giant metal structure
standing one hundred feet tall

4
00:00:21,087 --> 00:00:24,093
and almost a hundred
feet wide.... It's made of

5
00:00:24,093 --> 00:00:27,077
industrial strength steel that
can withstand the harshest

6
00:00:27,077 --> 00:00:31,053
winds and rain. This monolith
of the desert located at

7
00:00:31,053 --> 00:00:36,017
NASA's Dryden Flight Research
Center has been an unsung hero

8
00:00:36,017 --> 00:00:38,060
in the life of the Space
Shuttle Program for the last

9
00:00:38,060 --> 00:00:42,000
thirty-four years. This
steel giant is called the

10
00:00:42,000 --> 00:00:46,003
Mate-Demate Device,
or simply, the MDD.

11

00:00:50,033 --> 00:00:53,060

"Six inches... it moves three inches forward and three inches aft. And that's

12

00:00:53,060 --> 00:00:58,000

all the adjustment you have

13

00:00:58,000 --> 00:01:05,060

to set it on top of the 747. You can't move it anymore than that."

14

00:01:05,060 --> 00:01:08,063

"You gotta remember that thing was built to lift 330,000 lbs.

15

00:01:08,063 --> 00:01:10,080

See a shuttle up close, watch

16

00:01:10,080 --> 00:01:13,070

it take off on top of that 747 when it leaves here

17

00:01:13,070 --> 00:01:16,057

and it's just amazing... and to know you had something to do with it."

18

00:01:21,037 --> 00:01:26,020

After the shuttle makes its grand re-entry, landing safely while the world looks on.... and after

19

00:01:26,020 --> 00:01:30,000

the media has all shut off their cameras and gone home,

20

00:01:30,000 --> 00:01:34,043

a vital, albeit less glamorous event is just beginning the

21

00:01:34,043 --> 00:01:44,047

processing and mating of
the orbiter in the MDD.

22

00:01:44,047 --> 00:01:47,017

After landings at
Edwards Air Force Base,

23

00:01:47,017 --> 00:01:51,003

the MDD is used to hoist and
attach the shuttle orbiter

24

00:01:51,003 --> 00:01:53,050

onto to Shuttle Carrier
Aircraft so that it can be

25

00:01:53,050 --> 00:01:57,097

flown back to NASA's Kennedy
Space Center in Florida. While

26

00:01:57,097 --> 00:02:02,000

simple in concept, the
execution of this task is

27

00:02:02,000 --> 00:02:06,053

anything but, considering the
average landing weight of a

28

00:02:06,053 --> 00:02:10,013

shuttle is roughly 230,000lbs
and holds research and

29

00:02:10,013 --> 00:02:15,027

payloads acquired in outer space
... precious cargo indeed.

30

00:02:15,027 --> 00:02:18,087

In addition to "mating"
the orbiter to the

31

00:02:18,087 --> 00:02:21,063
shuttle carrier aircraft,
a modified Boeing 747,

32

00:02:21,063 --> 00:02:24,023
the MDD is utilized to
"process" the shuttle,

33

00:02:24,023 --> 00:02:27,067
a week-long procedure that
includes taking up the landing

34

00:02:27,067 --> 00:02:30,097
gear, attaching the tail cone,
and literally "battening down

35

00:02:30,097 --> 00:02:36,027
the hatches". "They have what
they call 'SCAPE Operations',

36

00:02:36,027 --> 00:02:39,097
and that's when they do the
actual de-fueling... and the

37

00:02:39,097 --> 00:02:44,020
people doing the de-fueling,
they have to be in a full

38

00:02:44,020 --> 00:02:49,000
suit. It's air
contained, self-contained,

39

00:02:49,000 --> 00:02:52,013
get's its own air and
everything... looks like those

40

00:02:52,013 --> 00:02:54,033
space walkers." During
the week of processing,

41

00:02:54,033 --> 00:02:57,047

the orbiter is lifted about
10 feet off the ground while

42

00:02:57,047 --> 00:03:01,047

crews work around the
clock. "That the basic idea,

43

00:03:01,047 --> 00:03:05,013

to put the shuttle on top of
the 747. That whole process

44

00:03:05,013 --> 00:03:09,037

involves a week of processing
to safe the vehicle, to put
it on the 747."

45

00:03:09,037 --> 00:03:14,030

Just before landing at Edwards,

46

00:03:14,030 --> 00:03:19,070

Kennedy Space Center deploys
about 120 people to Dryden to

47

00:03:19,070 --> 00:03:21,040

process the Orbiter.
Together with the Dryden team,

48

00:03:21,040 --> 00:03:25,013

this highly
specialized team of engineers,

49

00:03:25,013 --> 00:03:27,080

pilots and ground crew work in
unison under harsh conditions

50

00:03:27,080 --> 00:03:31,080

performing precision,
high-risk tasks with a fragile

51

00:03:31,080 --> 00:03:35,023
100-ton spacecraft. "If you
don't do your job and do it

52

00:03:35,023 --> 00:03:38,097
right, there is always
something that can happen. It

53

00:03:38,097 --> 00:03:42,067
could lead to
someone getting hurt,

54

00:03:42,067 --> 00:03:45,083
harming the shuttle... so you
have to make sure your job is

55

00:03:45,083 --> 00:03:50,030
done and done right and with
all the expertise you know and

56

00:03:50,030 --> 00:03:53,030
have. So, and that's really
what keeps you going is the
pride in doing that."

57

00:03:53,030 --> 00:03:56,057
Over the years,

58

00:03:56,057 --> 00:03:59,053
ground crews were able to
perfect the art of mating and

59

00:03:59,053 --> 00:04:02,020
processing the orbiter,
but never without risk and

60

00:04:02,020 --> 00:04:05,073
hardship. To fully appreciate
the complexity and scale of

61

00:04:05,073 --> 00:04:09,077

this undertaking, it is
helpful to understand how the

62

00:04:09,077 --> 00:04:11,027

MDD came to be, and how it
has served as an essential

63

00:04:11,027 --> 00:04:21,083

component in the success of
the STS program at large.

64

00:04:21,083 --> 00:04:27,057

As the sun was setting on the
Apollo space program in the

65

00:04:27,057 --> 00:04:30,070

early '70's, a new program,
the Space Transportation

66

00:04:30,070 --> 00:04:33,080

System Space Shuttle
was dawning. One defining

67

00:04:33,080 --> 00:04:37,077

distinction between the two
programs was that the space

68

00:04:37,077 --> 00:04:40,007

shuttle was a
reusable spacecraft,

69

00:04:40,007 --> 00:04:43,053

unlike it's
predecessor. The shuttle,

70

00:04:43,053 --> 00:04:47,050

or orbiter, was to be lofted
into low Earth orbit with the

71

00:04:47,050 --> 00:04:49,083
energy of two solid rockets
and the orbiters three

72

00:04:49,083 --> 00:04:52,003
engines fueled by an enormous
external tank filled with

73

00:04:52,003 --> 00:04:55,027
liquid oxygen and liquid
hydrogen. Upon it's return

74

00:04:55,027 --> 00:04:59,023
from space missions, the
orbiter would re-enter the

75

00:04:59,023 --> 00:05:02,070
Earth's atmosphere, flying
without power like a glider,

76

00:05:02,070 --> 00:05:06,013
and land on a long, paved
runway like traditional

77

00:05:06,013 --> 00:05:09,067
aircraft. These methods of
launch and re-entry proved to

78

00:05:09,067 --> 00:05:13,050
be very effective. With an
extremely short wing span and

79

00:05:13,050 --> 00:05:17,070
without the expendable
external fuel tank used for

80

00:05:17,070 --> 00:05:20,093
lift-off however, the orbiter
lacked the ability to take off

81

00:05:20,093 --> 00:05:23,053
and fly like a conventionally
powered aircraft in the

82

00:05:23,053 --> 00:05:25,093
Earth's atmosphere. From
the start of the program,

83

00:05:25,093 --> 00:05:28,097
engineers recognized that the
orbiters might not be able to

84

00:05:28,097 --> 00:05:31,057
return to their launch site
at the Kennedy Space Center in

85

00:05:31,057 --> 00:05:34,087
Florida because of an engine
malfunction after lift-off,

86

00:05:34,087 --> 00:05:38,060
or because unfavorable weather
conditions. "Shuttle can't

87

00:05:38,060 --> 00:05:40,090
land in the rain, no. Once
it breaks through the Earth's

88

00:05:40,090 --> 00:05:43,090
atmosphere, it starts cooling
off and there's enough space

89

00:05:43,090 --> 00:05:48,067
between the tiles that
any water penetrating that

90

00:05:48,067 --> 00:05:50,033
actually hydraulically pushes
the tile off of the shuttle.

91

00:05:50,033 --> 00:05:52,063

The water doesn't
have any place to go,

92

00:05:52,063 --> 00:05:56,077

so... The tiles
are just glued on,

93

00:05:56,077 --> 00:06:00,013

that's why landing at Kennedy,
always a concern because you

94

00:06:00,013 --> 00:06:02,040

know how much rain they
get there. And we're usually

95

00:06:02,040 --> 00:06:05,003

pretty dry here."

96

00:06:05,003 --> 00:06:07,073

In this event, a landing
elsewhere would
necessitate bringing the

97

00:06:07,073 --> 00:06:10,087

shuttle back to Florida...
which meant the need for a

98

00:06:10,087 --> 00:06:15,037

structure capable of lifting
the orbiter off the ground and

99

00:06:15,037 --> 00:06:18,060

placing it on the back of the
747 Shuttle Carrier Aircraft.

100

00:06:18,060 --> 00:06:21,090

Using cranes to lift and
attach an orbiter was deemed a

101

00:06:21,090 --> 00:06:23,070

far too delicate balancing act
to sustain over the course of

102

00:06:23,070 --> 00:06:28,050

the Shuttle Program. It soon
became clear that there was

103

00:06:28,050 --> 00:06:32,087

need to build a permanent and
reliable structure to achieve

104

00:06:32,087 --> 00:06:37,017

this task. Hence, the idea of
the Mate De-Mate Device was

105

00:06:37,017 --> 00:06:41,083

born and plans to fabricate
and construct the first MDD

106

00:06:41,083 --> 00:06:44,070

were put into action.

107

00:06:44,070 --> 00:06:49,040

The Kennedy Space Center
awarded a \$1.2-million-plus
contract to the

108

00:06:49,040 --> 00:06:55,080

George A. Fuller Company,
a division of the
Northrop Corporation,

109

00:06:55,080 --> 00:06:59,087

to design and build the
first Mate Demate Device.

110

00:06:59,087 --> 00:07:04,003

Soon after, the MDD at Kennedy

Space Center was constructed

111

00:07:04,003 --> 00:07:08,000
in 1976. In the early
stages of the shuttle program,

112

00:07:08,000 --> 00:07:11,087
it was especially important to
build an MDD at Dryden first.

113

00:07:11,087 --> 00:07:18,090
Assembled in
nearby Palmdale, CA,

114

00:07:18,090 --> 00:07:22,030
the first three
orbiters, Enterprise,

115

00:07:22,030 --> 00:07:24,090
Columbia, and Challenger, were
actually trucked to Dryden.

116

00:07:24,090 --> 00:07:27,050
Once there, the MDD would be
utilized for the first time in

117

00:07:27,050 --> 00:07:30,003
the historic and
groundbreaking Approach and

118

00:07:30,003 --> 00:07:32,090
Landing Test program in 1977.
The Approach and Landing Test

119

00:07:32,090 --> 00:07:35,060
program, or ALT, was an
essential component in the

120

00:07:35,060 --> 00:07:38,040
development of the space

shuttle program. Used to

121

00:07:38,040 --> 00:07:42,043

validate the flying characteristics of the orbiter

122

00:07:42,043 --> 00:07:46,077

upon re-entry & landing, and test it's systems in flight,

123

00:07:46,077 --> 00:07:50,083

the ALT program made use of the MDD for the first time to

124

00:07:50,083 --> 00:07:54,080

load and unload Enterprise onto the Boeing 747 in a

125

00:07:54,080 --> 00:08:02,017

series of high-risk test flights in 1977.

126

00:08:02,017 --> 00:08:07,067

In 1982, NASA arranged to have a permanent Mate-Demate Device

127

00:08:07,067 --> 00:08:10,053

erected in Palmdale. The Orbiter Loading Facility,

128

00:08:10,053 --> 00:08:14,070

or OLF, was originally built for use by the Air Force at

129

00:08:14,070 --> 00:08:18,020

Vandenberg Air Force Base, where it planned to launch a

130

00:08:18,020 --> 00:08:21,033

shuttle for its own missions.

When the Air Force cancelled

131

00:08:21,033 --> 00:08:25,010
its plans for a dedicated
orbiter and launch facility on

132

00:08:25,010 --> 00:08:29,010
the West Coast, the OLF
was relocated to Palmdale.

133

00:08:29,010 --> 00:08:31,047
"Several years ago they
were doing refurbishment

134

00:08:31,047 --> 00:08:34,023
of the shuttles in Palmdale at
the Boeing facility and the

135

00:08:34,023 --> 00:08:40,087
orbiter would
fly in on the 747,

136

00:08:40,087 --> 00:08:42,090
and it would fly into Palmdale
and we would offload it using

137

00:08:42,090 --> 00:08:44,093
the OLF. And then we would
transfer the shuttle over to

138

00:08:44,093 --> 00:08:46,070
the Boeing folks and
they would to the

139

00:08:46,070 --> 00:08:48,053
shuttle modifications,
and then, you know,

140

00:08:48,053 --> 00:08:51,020
maybe a year later we'd

pick the shuttle up

141

00:08:51,020 --> 00:08:52,023
and reverse the process -
put it back on the 747

142

00:08:52,023 --> 00:09:01,073
and fly it back to Florida."

143

00:09:01,073 --> 00:09:09,000
The shuttle orbits the Earth
at mach 25, and makes it's
landing at over 200mph.

144

00:09:09,000 --> 00:09:13,053
But when the orbiter finally
comes to a halt on the ground,

145

00:09:13,053 --> 00:09:15,060
the massive spacecraft is not
easy maneuver. After landing,

146

00:09:15,060 --> 00:09:18,053
the orbiter is towed about two
miles to the MDD. A process

147

00:09:18,053 --> 00:09:23,010
that takes over an hour.
Once situated in the MDD,

148

00:09:23,010 --> 00:09:28,083
the orbiter is lifted off the
ground and held there for days

149

00:09:28,083 --> 00:09:32,053
while crews work under
and over the orbiter,

150

00:09:32,053 --> 00:09:36,020
preparing it for it's return

flight. Because it is not

151

00:09:36,020 --> 00:09:38,090
hermetically sealed, the cargo
bay is kept at a positive

152

00:09:38,090 --> 00:09:43,017
pressure and the electronics
in the vehicle are kept

153

00:09:43,017 --> 00:09:46,030
operational. This ensures
that equipment and any

154

00:09:46,030 --> 00:09:50,020
experiments on and in the
orbiter are kept cool

155

00:09:50,020 --> 00:09:53,037
throughout its stay in the MDD.

156

00:09:53,037 --> 00:09:56,047
"Anything that's in the payload
bay stays there because on the
ground, the payload

157

00:09:56,047 --> 00:09:58,053
bay, the doors aren't capable of
opening themselves. They have

158

00:09:58,053 --> 00:10:00,050
a special apparatus back at
the Cape to hook into the

159

00:10:00,050 --> 00:10:03,080
doors to open it. The doors
don't weigh anything in space,

160

00:10:03,080 --> 00:10:09,030
so they're driven with

very small motors."

161

00:10:09,030 --> 00:10:13,043

The MDD is an open-truss structure standing about 100ft tall

162

00:10:13,043 --> 00:10:17,020

with platforms every 20ft. A horizontal unit cantilevers

163

00:10:17,020 --> 00:10:21,020

70ft out from the main tower units,

164

00:10:21,020 --> 00:10:27,013

guiding and controlling the sling-back hoist mechanism

165

00:10:27,013 --> 00:10:31,097

that attaches to the orbiters to raise and lower them.

166

00:10:31,097 --> 00:10:34,040

Three large hoists are used to raise and lower the lift beams.

167

00:10:34,040 --> 00:10:36,083

Two of the hoists are connected to the aft portion of the lift

168

00:10:36,083 --> 00:10:39,033

beam and one hoist is attached to the beams forward section.

169

00:10:39,033 --> 00:10:42,067

The three hoists operate simultaneously,

170

00:10:42,067 --> 00:10:45,080

and they can lift up
to 120 tons each.

171

00:10:45,080 --> 00:10:49,060

There are six stationary
platform levels, two moveable
Access/Service Platforms,

172

00:10:49,060 --> 00:10:54,017

one for each side
of the orbiter,

173

00:10:54,017 --> 00:10:57,057

and other smaller,
moveable platforms.

174

00:10:57,057 --> 00:11:01,050

"The old MDD was
grey and red. Now

175

00:11:01,050 --> 00:11:06,010

if you down there,
it's all grey".

176

00:11:06,010 --> 00:11:08,097

In 2004, Dryden took on
the enormous endeavor

177

00:11:08,097 --> 00:11:12,063

of removing the lead based paint
that covered the entire MDD.

178

00:11:12,063 --> 00:11:17,090

As part of a five-month
process, contractors blasted
the paint off the MDD.

179

00:11:17,090 --> 00:11:20,070

"The job was huge. There was so
much scaffolding and tenting.

180

00:11:20,070 --> 00:11:23,093

Once you got a hole in the tent,
you had to stop operations. No

181

00:11:23,093 --> 00:11:27,003

more blasting until it
was repaired because
there was some kind of

182

00:11:27,003 --> 00:11:32,060

positive ventilation
inside the tent that kept
the dust down instead

183

00:11:32,060 --> 00:11:37,000

of coming out. We were having,
you know, 4, 5, 6 days of 30
mph winds, constantly."

184

00:11:37,000 --> 00:11:42,073

By adding an ingredient
to the blasting material

185

00:11:42,073 --> 00:11:44,033

called Blastox,
over 200,000 lbs

186

00:11:44,033 --> 00:11:46,090

of waste material was

187

00:11:46,090 --> 00:11:49,040

spared from being sent to

188

00:11:49,040 --> 00:11:52,023

a waste management site.
Instead, the waste compound was

189

00:11:52,023 --> 00:11:54,003

sent to a Portland cement plant
where it was burned in a kiln.

190

00:11:54,003 --> 00:11:58,010

"It's a zinc finish,

191

00:11:58,010 --> 00:12:04,027

self healing... so if

it gets a scratch,

192

00:12:04,027 --> 00:12:04,033

somehow it grows and turns

back into... into a zinc.

It's amazing stuff."

193

00:12:14,000 --> 00:12:15,023

"Don't have much to do

with launch, but we know

we got it back there

194

00:12:15,023 --> 00:12:19,057

safe from the last time...

so, always a sense of

pride in everything."

195

00:12:19,057 --> 00:12:22,073

Despite the intermittent

landing schedule at Dryden,

196

00:12:22,073 --> 00:12:27,073

the support crew operating

the MDD has an astonishing

record of preparedness.

197

00:12:27,073 --> 00:12:29,010

"I'd like to think

of myself as a good

198

00:12:29,010 --> 00:12:32,000

American for doing that.

199

00:12:32,000 --> 00:12:35,093

All my guys down there feel
the same way I'm sure."

200

00:12:35,093 --> 00:12:36,060

"Yeah, you need to step
back at times and

201

00:12:36,060 --> 00:12:39,023

realize, wow, this is what I'm
doing,

202

00:12:39,023 --> 00:12:41,067

it's just a small group
of folks that do it."

203

00:12:41,067 --> 00:12:44,073

Throughout it's history, the
MDD and it's faithful crew

204

00:12:44,073 --> 00:12:48,073

had a 100% mission success
rate over it's 34 years of

205

00:12:48,073 --> 00:12:51,033

service to the Shuttle Program.

206

00:12:51,033 --> 00:12:55,090

"When I look back someday,
I know I'll think of these
times and realize just how

207

00:12:55,090 --> 00:12:59,040

fortunate I was to have worked
on the program and uh... it's

208

00:12:59,040 --> 00:13:02,070

just kind of nice
to know that uh,

209

00:13:02,070 --> 00:13:05,083

you know, you were a part
of uh... something big. So,