
PAO

1
00:00:00,446 --> 00:00:02,426
>> Dan Huot: Well,
welcome back inside

2
00:00:02,426 --> 00:00:03,716
of Mission Control, Houston.

3
00:00:03,906 --> 00:00:06,236
Dan Huot here, and I'm
joined now by Ann Esbeck,

4
00:00:06,236 --> 00:00:08,306
one of our ADCO flight
controllers here

5
00:00:08,306 --> 00:00:09,246
in Mission Control.

6
00:00:09,586 --> 00:00:11,656
Now Anne, first off, thanks
so much for being here.

7
00:00:12,016 --> 00:00:13,746
It's always great to
get a little insight

8
00:00:13,746 --> 00:00:15,486
on what you guys are
doing behind the scenes.

9
00:00:15,906 --> 00:00:17,726
So, first off, what
does ADCO stand for?

10
00:00:17,726 --> 00:00:19,126
What is it that you
guys are doing

11
00:00:19,346 --> 00:00:20,766

for the International
Space Station?

12
00:00:20,966 --> 00:00:21,196
>> Ann Esbeck: Okay.

13
00:00:21,196 --> 00:00:23,146
ADCO stands for the
Attitude Determination

14
00:00:23,146 --> 00:00:24,086
and Control Officer.

15
00:00:24,536 --> 00:00:26,316
So, essentially,
the simplest way

16
00:00:26,316 --> 00:00:27,776
to describe what we
do is we're the pilot.

17
00:00:27,966 --> 00:00:28,586
>> Dan Huot: So you're
the one sitting

18
00:00:28,586 --> 00:00:30,776
at the sticks flying the
International Space Station,

19
00:00:30,776 --> 00:00:31,196
basically?

20
00:00:31,286 --> 00:00:31,426
>> Ann Esbeck: Yes.

21
00:00:31,556 --> 00:00:33,636
So we don't actually get a
stick down at the console,

22

00:00:33,636 --> 00:00:35,816
but we do get to send our
commands via the computers.

23
00:00:36,336 --> 00:00:39,616
So we orient the space station
where it needs to be going,

24
00:00:39,836 --> 00:00:40,706
and make sure it stays there.

25
00:00:41,316 --> 00:00:41,616
>> Dan Huot: Okay.

26
00:00:42,076 --> 00:00:45,176
And so you're orienting
the space station

27
00:00:45,176 --> 00:00:47,536
and that's really important
for visiting vehicles.

28
00:00:47,536 --> 00:00:49,266
Right? We have a
[inaudible] coming up soon.

29
00:00:49,546 --> 00:00:51,326
What's some of the work
you guys have to do

30
00:00:51,326 --> 00:00:53,626
to get the station ready
for any visiting vehicle?

31
00:00:54,266 --> 00:00:55,716
>> Ann Esbeck: So one of the
primary things that we have

32
00:00:55,716 --> 00:00:58,736
to do is that we hand over

control to the Russian segment,

33
00:00:59,146 --> 00:01:02,426
and typically our attitude
control is performed via four

34
00:01:02,426 --> 00:01:03,416
control [inaudible] gyros,

35
00:01:03,866 --> 00:01:06,796
and those gyros are 200
pound spinning discs

36
00:01:07,116 --> 00:01:08,246
that produce momentum.

37
00:01:08,246 --> 00:01:10,926
As we move that momentum
through space we can control

38
00:01:10,926 --> 00:01:12,746
where the space station points.

39
00:01:13,026 --> 00:01:15,696
That doesn't work whenever you
have to maneuver the vehicle

40
00:01:15,696 --> 00:01:18,646
over a large direction.

41
00:01:18,726 --> 00:01:20,536
So in this case we actually need

42
00:01:20,536 --> 00:01:22,766
to pitch the vehicle
up 90 degrees.

43
00:01:23,236 --> 00:01:24,786
So instead of flying,

like you would think

44
00:01:24,786 --> 00:01:27,406
of an airplane flying
straight and level

45
00:01:27,566 --> 00:01:29,246
so you have your wings out,

46
00:01:29,246 --> 00:01:32,206
we fly essentially
pitched 90 degrees up.

47
00:01:32,206 --> 00:01:34,766
So instead of flying this
way, you're going to come up

48
00:01:34,766 --> 00:01:35,946
and pitch this direction here,

49
00:01:35,946 --> 00:01:37,666
and then continue to
fly through space.

50
00:01:37,806 --> 00:01:40,296
And we're doing that because
the [inaudible] that's coming

51
00:01:40,516 --> 00:01:43,456
up to dock is docking on the
nadir side of the vehicle.

52
00:01:43,516 --> 00:01:44,826
So on the bottom
side of the vehicle.

53
00:01:44,826 --> 00:01:45,076
>> Dan Huot: Okay.

54

00:01:45,316 --> 00:01:45,996
>> Ann Esbeck: So
we need to make sure

55
00:01:45,996 --> 00:01:49,556
that that docking port is
available for that vehicle

56
00:01:49,556 --> 00:01:52,526
to reach, and so by pitching
the vehicle up they can come

57
00:01:52,566 --> 00:01:54,976
in along the velocity vector
and dock nice and easy

58
00:01:55,556 --> 00:01:56,876
with the sun pointing
right where it needs

59
00:01:56,926 --> 00:01:58,246
to so they can see it.

60
00:01:58,466 --> 00:01:59,406
>> Dan Huot: So flying.

61
00:01:59,406 --> 00:02:01,736
Flying in space, you know,
isn't quite like flying

62
00:02:01,736 --> 00:02:03,486
in the atmosphere
where you can just kind

63
00:02:03,486 --> 00:02:06,326
of turn your spaceship,
you know, the wrong way

64
00:02:06,386 --> 00:02:08,886
to how it looks and you're still

flying because you don't have

65
00:02:08,886 --> 00:02:11,616
that wind resistance
and problems like that.

66
00:02:11,616 --> 00:02:14,186
So we're looking at a picture
right now of the [inaudible]

67
00:02:14,186 --> 00:02:15,936
and how it'll look
when it's docked.

68
00:02:16,476 --> 00:02:19,056
So aside -- So you're going to
be flipping it up 90 degrees.

69
00:02:19,056 --> 00:02:21,346
Is there any other maneuvers
you're going to be doing

70
00:02:21,346 --> 00:02:23,306
to get the station ready for
that [inaudible] docking?

71
00:02:23,616 --> 00:02:25,796
>> Ann Esbeck: So the order
of operations for the day is

72
00:02:25,796 --> 00:02:27,786
that we actually turn
on a lot of different --

73
00:02:27,926 --> 00:02:30,876
they're called ORUs, on
orbit replacement units,

74
00:02:31,096 --> 00:02:33,646
and that's things like

an extra rate gyro

75
00:02:33,766 --> 00:02:36,646
so that we can measure the
rates on the space station

76
00:02:36,646 --> 00:02:39,926
as we're doing a maneuver and it
gives us additional redundancy.

77
00:02:39,926 --> 00:02:42,806
So if we have a sensor
fail during the operation,

78
00:02:43,076 --> 00:02:44,666
we have an additional
one already turned

79
00:02:44,666 --> 00:02:46,226
on so it'll switch
over automatically

80
00:02:46,226 --> 00:02:47,466
and we don't have
any interruptions.

81
00:02:47,546 --> 00:02:49,526
So we have a lot of
configuration that happens

82
00:02:49,526 --> 00:02:52,716
on the space station prior
to getting ready to dock,

83
00:02:53,046 --> 00:02:55,976
and that -- all of that's
completed well before we hand

84
00:02:55,976 --> 00:02:57,066
over to the Russian segment.

85
00:02:57,236 --> 00:02:59,336
Then we hand over to the Russian
segment, perform the maneuver

86
00:02:59,336 --> 00:03:02,566
up to 90 degrees, and we'll
be flying zero ninety zero.

87
00:03:02,936 --> 00:03:05,556
And then, as the crew is
coming in, they will monitor

88
00:03:05,556 --> 00:03:07,186
to determine whether
or not we are holding

89
00:03:07,186 --> 00:03:09,086
to a tight enough
attitude for them to dock.

90
00:03:09,546 --> 00:03:11,306
If, for some reason,
they don't think

91
00:03:11,356 --> 00:03:13,796
that the docking is going
well, they will hand over

92
00:03:13,796 --> 00:03:16,216
and do what's called
a manual docking

93
00:03:16,496 --> 00:03:17,916
and they actually
take the [inaudible]

94
00:03:17,916 --> 00:03:21,336
out of their automatic mode and
fly the vehicle in manually.

95
00:03:21,806 --> 00:03:24,956
And then, once we're docked, the
vehicle will go to free drift.

96
00:03:25,306 --> 00:03:27,886
When the vehicle's in free
drift it reduces the loads

97
00:03:28,386 --> 00:03:31,876
on the docking mechanism so that
they can close all of the hooks

98
00:03:32,736 --> 00:03:35,716
and do a hard mating properly.

99
00:03:36,226 --> 00:03:40,736
After they get mated, then we
can turn the thrusters back on

100
00:03:40,776 --> 00:03:42,636
and regain attitude
control and get back

101
00:03:42,636 --> 00:03:44,316
to that zero ninety
zero attitude.

102
00:03:44,776 --> 00:03:47,736
After we've gotten back to that
attitude, we'll then pitch back

103
00:03:47,736 --> 00:03:50,416
down into our normal
flying attitude.

104
00:03:50,926 --> 00:03:54,206
And once we're there we'll
actually disable thrusters again

105
00:03:54,846 --> 00:03:58,496
so that the hooks can be
installed on the [inaudible],

106
00:03:58,616 --> 00:04:00,406
and open the hatches so
the crew can come inside.

107
00:04:00,926 --> 00:04:02,916
After the hooks have been
installed then we'll turn the

108
00:04:02,916 --> 00:04:05,356
thrusters back on and we'll
be able to continue our day.

109
00:04:05,616 --> 00:04:06,036
>> Dan Huot: Okay.

110
00:04:06,036 --> 00:04:09,476
Wow. So not as easy as just,
you know, two things linking

111
00:04:09,476 --> 00:04:11,026
up when they're flying
at -- what?

112
00:04:11,066 --> 00:04:12,866
17 thousand, 500 miles and hour.

113
00:04:13,156 --> 00:04:14,066
It's pretty tricky to go --

114
00:04:14,066 --> 00:04:14,346
>> Ann Esbeck: Yeah.

115
00:04:14,346 --> 00:04:15,636
As simple as that sounds, no.

116
00:04:15,636 --> 00:04:16,926
We have a lot of
other operations

117
00:04:16,926 --> 00:04:17,776
that we have to do
during the day.

118
00:04:18,056 --> 00:04:18,236
>> Dan Huot: Okay.

119
00:04:18,236 --> 00:04:20,346
Well, what about some of
the other visiting vehicles?

120
00:04:20,346 --> 00:04:22,906
I know you're pitching
90 degrees for this one.

121
00:04:23,116 --> 00:04:25,976
Is that kind of standard
for most vehicles or --

122
00:04:25,976 --> 00:04:27,476
>> Ann Esbeck: If we're
going to dock nadir which is

123
00:04:27,476 --> 00:04:29,076
on the bottom side of
the space station, yes,

124
00:04:29,076 --> 00:04:31,406
we'll typically dock
at zero ninety zero.

125
00:04:32,076 --> 00:04:34,386
If we have something that's
coming to the aft portion

126

00:04:34,386 --> 00:04:36,166
of the vehicle, so the
backside of the vehicle,

127
00:04:36,166 --> 00:04:38,086
we'll have a different attitude.

128
00:04:38,086 --> 00:04:40,966
Typically we actually stay
pretty close to our TEA

129
00:04:40,966 --> 00:04:43,686
which is our torque
equilibrium attitude.

130
00:04:43,896 --> 00:04:45,866
So that's what we
fly on a nominal day.

131
00:04:46,426 --> 00:04:48,546
Or we might have to turn the
space station around backwards

132
00:04:48,926 --> 00:04:52,136
to put that point of the
vehicle in the velocity vector.

133
00:04:52,136 --> 00:04:54,736
So that's called a 180
degree [inaudible] maneuver.

134
00:04:54,736 --> 00:04:57,046
So instead of flying
straight and level this way,

135
00:04:57,046 --> 00:04:58,196
we actually turn
around backwards

136
00:04:58,476 --> 00:05:00,966

and then fly backwards
for that docking.

137
00:05:01,096 --> 00:05:03,426
And then there are also others
where we'll actually turn

138
00:05:03,426 --> 00:05:06,066
around 180 degrees the
day before and then pitch

139
00:05:06,066 --> 00:05:07,126
up the day of docking.

140
00:05:07,576 --> 00:05:09,196
And that's so that we can
dock to the zenith port.

141
00:05:09,196 --> 00:05:10,696
And then we'll pitch back down

142
00:05:10,696 --> 00:05:13,386
and then turn another 180
degrees back before we get back

143
00:05:13,416 --> 00:05:13,946
to normal ops.

144
00:05:14,336 --> 00:05:16,786
And those sort of dockings
actually take a 3 day time

145
00:05:16,786 --> 00:05:19,596
period because we have to
maneuver the day before and wait

146
00:05:19,596 --> 00:05:21,346
in that new -- It's
called [inaudible].

147
00:05:21,566 --> 00:05:26,026
And then on the day of docking
we'll do the pitch up attitude,

148
00:05:26,026 --> 00:05:27,406
and then pitch back
down following.

149
00:05:27,486 --> 00:05:28,646
And then we have to
wait another day,

150
00:05:28,756 --> 00:05:31,276
and then we'll maneuver back
to the nominal attitude.

151
00:05:31,756 --> 00:05:32,196
>> Dan Huot: All right.

152
00:05:32,226 --> 00:05:34,406
So flying in space, you're
making it sound a lot harder

153
00:05:34,406 --> 00:05:35,346
than I always thought it was.

154
00:05:35,446 --> 00:05:37,416
But I'm glad you
guys are on top of it

155
00:05:37,416 --> 00:05:38,516
and you're always
controlling it.

156
00:05:38,516 --> 00:05:40,346
Well, we'll certainly
be looking forward

157
00:05:40,346 --> 00:05:42,626

to all the work you're doing
to get this station ready

158
00:05:42,626 --> 00:05:43,676
for that [inaudible] docking.

159
00:05:43,676 --> 00:05:45,416
And thanks so much
for coming on today

160
00:05:45,416 --> 00:05:47,666
and telling us a little bit
about what ADCOs are doing

161
00:05:47,666 --> 00:05:49,486
to keep our space
station flying.

162
00:05:49,626 --> 00:05:50,036
>> Ann Esbeck: No problem.

163
00:05:50,036 --> 00:05:50,606
I'm glad to be here.