Origins, Worlds, & Life: A Decadal Strategy for Planetary Science & Astrobiology

1
00:00:04,390 --> 00:00:02,550
uh welcome to this session on the

2
00:00:05,990 --> 00:00:04,400
decadal survey on astrobiology and

3
00:00:07,749 --> 00:00:06,000
planetary science or

4
00:00:09,669 --> 00:00:07,759
planetary science and astrobiology as

5
00:00:12,709 --> 00:00:09,679
the report title says

6
00:00:15,430 --> 00:00:12,719
i'm david smith i was the study director

7
00:00:16,710 --> 00:00:15,440
and i will be introducing a speaker

8
00:00:18,150 --> 00:00:16,720
robin kanup

9
00:00:20,150 --> 00:00:18,160
assistant

10
00:00:21,429 --> 00:00:20,160
vice president of southwest research

11
00:00:23,269 --> 00:00:21,439
institute

12
00:00:25,189 --> 00:00:23,279
who was one of the co-chairs

13
00:00:27,910 --> 00:00:25,199

the other co-chair phil christensen from

14
00:00:31,589 --> 00:00:27,920
arizona state university sends his

15
00:00:34,150 --> 00:00:31,599
apologies he's actually at jpl today

16
00:00:35,830 --> 00:00:34,160
delivering his instrument for europa

17
00:00:37,270 --> 00:00:35,840
clipper

18
00:00:40,549 --> 00:00:37,280
so

19
00:00:43,430 --> 00:00:40,559
robin why don't you take it away

20
00:00:45,270 --> 00:00:43,440
thank you it's a pleasure to be here and

21
00:00:47,190 --> 00:00:45,280
to get to

22
00:00:50,389 --> 00:00:47,200
present some highlights from our recent

23
00:00:52,630 --> 00:00:50,399
decadal survey that was released in mid

24
00:00:54,630 --> 00:00:52,640
april uh particularly those that we

25
00:00:57,510 --> 00:00:54,640
think will be uh hopefully of most

26
00:00:59,189 --> 00:00:57,520
interest to this group

27
00:01:00,310 --> 00:00:59,199
so our process is

28
00:01:02,470 --> 00:01:00,320
is uh

29
00:01:05,270 --> 00:01:02,480
defined by what's called the statement

30
00:01:08,070 --> 00:01:05,280
of task from our sponsors

31
00:01:10,789 --> 00:01:08,080
nasa planetary science division or psd

32
00:01:13,429 --> 00:01:10,799
and national science foundation

33
00:01:14,630 --> 00:01:13,439
compared to the prior decadal survey in

34
00:01:17,590 --> 00:01:14,640
our field

35
00:01:19,190 --> 00:01:17,600
we too provide an overall synthesis of

36
00:01:21,990 --> 00:01:19,200
the state of knowledge

37
00:01:23,830 --> 00:01:22,000
identify the top research questions to

38
00:01:26,789 --> 00:01:23,840

be addressed in the next decade and

39
00:01:28,710 --> 00:01:26,799
prioritize various research activities

40
00:01:30,710 --> 00:01:28,720
and in particular missions to best

41
00:01:33,670 --> 00:01:30,720
address those questions

42
00:01:35,429 --> 00:01:33,680
as well as

43
00:01:38,230 --> 00:01:35,439
recommendations related to overall

44
00:01:40,069 --> 00:01:38,240
programmatic balance technology and

45
00:01:43,510 --> 00:01:40,079
infrastructure development needs and

46
00:01:44,630 --> 00:01:43,520
decision rules to address any budgetary

47
00:01:47,749 --> 00:01:44,640
changes

48
00:01:48,870 --> 00:01:47,759
key distinctions of the report this time

49
00:01:50,710 --> 00:01:48,880
include

50
00:01:53,270 --> 00:01:50,720
consideration of the state of profession

51
00:01:55,109 --> 00:01:53,280
and issues of diversity equity inclusion

52
00:01:57,109 --> 00:01:55,119
and accessibility

53
00:01:59,590 --> 00:01:57,119
our report for the first time is

54
00:02:02,389 --> 00:01:59,600
organized by overarching scientific

55
00:02:04,870 --> 00:02:02,399
questions and topics rather than by

56
00:02:07,190 --> 00:02:04,880
destination in the solar system

57
00:02:10,150 --> 00:02:07,200
as our title indicates we have a much

58
00:02:13,750 --> 00:02:10,160
greater emphasis on astrobiology we also

59
00:02:15,990 --> 00:02:13,760
included discussion of planetary defense

60
00:02:27,510 --> 00:02:16,000
and

61
00:02:32,470 --> 00:02:29,670
the structure of the survey shown on the

62
00:02:35,430 --> 00:02:32,480
left we had a steering group and six

63
00:02:38,309 --> 00:02:35,440

panels based on destination

64
00:02:40,470 --> 00:02:38,319
but the structure of the report shown in

65
00:02:42,869 --> 00:02:40,480
the middle again is by

66
00:02:45,190 --> 00:02:42,879
overarching priority science questions

67
00:02:46,949 --> 00:02:45,200
and by topic so each one of those boxes

68
00:02:49,509 --> 00:02:46,959
in the middle indicates a different

69
00:02:52,229 --> 00:02:49,519
chapter in the report each chapter was

70
00:02:54,150 --> 00:02:52,239
drafted drafted by a writing group

71
00:02:55,990 --> 00:02:54,160
the writing group being comprised of

72
00:02:58,630 --> 00:02:56,000
members of both the steering group and

73
00:03:00,229 --> 00:02:58,640
the panels that had relevant interest

74
00:03:02,390 --> 00:03:00,239
and expertise

75
00:03:04,390 --> 00:03:02,400
the highest level recommendations in the

76
00:03:06,869 --> 00:03:04,400
report are contained in the programmatic

77
00:03:10,070 --> 00:03:06,879
chapter that's chapter 22.

78
00:03:11,110 --> 00:03:10,080
it's a quite large report over 700 pages

79
00:03:13,350 --> 00:03:11,120
in total

80
00:03:15,110 --> 00:03:13,360
i point you to a table at the very

81
00:03:18,070 --> 00:03:15,120
beginning of the report that gives a

82
00:03:22,149 --> 00:03:18,080
detailed guide by topic on where to find

83
00:03:26,630 --> 00:03:25,110
this is our steering group

84
00:03:28,630 --> 00:03:26,640
this was our leadership group

85
00:03:30,949 --> 00:03:28,640
responsible for the top level

86
00:03:32,869 --> 00:03:30,959
prioritizations and recommendations with

87
00:03:35,430 --> 00:03:32,879
expertise across

88
00:03:37,509 --> 00:03:35,440

the scope of our scientific technical

89
00:03:38,630 --> 00:03:37,519
and policy

90
00:03:39,509 --> 00:03:38,640
task

91
00:03:42,149 --> 00:03:39,519
and

92
00:03:44,390 --> 00:03:42,159
they as you can see included multiple

93
00:03:47,670 --> 00:03:44,400
people with strong astrobiology

94
00:03:50,470 --> 00:03:47,680
background and expertise

95
00:03:52,869 --> 00:03:50,480
here are the membership of our

96
00:03:53,990 --> 00:03:52,879
six panels

97
00:03:56,470 --> 00:03:54,000
and

98
00:03:58,309 --> 00:03:56,480
the first name listed in each is the

99
00:03:59,910 --> 00:03:58,319
chair of the panel and the vice chair of

100
00:04:01,350 --> 00:03:59,920
each of these panels was also a member

101
00:04:02,710 --> 00:04:01,360
of the steering group

102
00:04:03,910 --> 00:04:02,720
to

103
00:04:05,830 --> 00:04:03,920
guarantee

104
00:04:08,630 --> 00:04:05,840
communication between the panels and the

105
00:04:14,630 --> 00:04:11,990
a couple notes on our process we started

106
00:04:17,110 --> 00:04:14,640
just after the pandemic began

107
00:04:19,590 --> 00:04:17,120
this decadal was the only one conducted

108
00:04:22,550 --> 00:04:19,600
entirely remotely

109
00:04:24,629 --> 00:04:22,560
we received more than 500 white papers

110
00:04:26,790 --> 00:04:24,639
that was about twice the number received

111
00:04:28,870 --> 00:04:26,800
in the prior planetary decadal

112
00:04:30,790 --> 00:04:28,880
we had a great number of all remote

113
00:04:33,030 --> 00:04:30,800

meetings you can see the numbers here

114
00:04:35,590 --> 00:04:33,040
more than 150 panel meetings more than

115
00:04:36,790 --> 00:04:35,600
20 steering group meetings most of those

116
00:04:39,189 --> 00:04:36,800
multi-day

117
00:04:41,350 --> 00:04:39,199
with more than 300 presentations by

118
00:04:43,909 --> 00:04:41,360
external speakers

119
00:04:46,230 --> 00:04:43,919
the list here indicates some of our main

120
00:04:49,270 --> 00:04:46,240
milestones in our process

121
00:04:51,670 --> 00:04:49,280
a big part of our process was reviewing

122
00:04:53,189 --> 00:04:51,680
prior planetary mission concept studies

123
00:04:55,590 --> 00:04:53,199
that had been performed before the

124
00:04:57,830 --> 00:04:55,600
decadal started as well as identifying

125
00:04:58,790 --> 00:04:57,840
and conducting new studies as part of

126
00:05:06,310 --> 00:04:58,800
our

127
00:05:08,790 --> 00:05:06,320
prioritizations but a fundamental step

128
00:05:10,629 --> 00:05:08,800
of importance in this process was the

129
00:05:13,110 --> 00:05:10,639
initial identification

130
00:05:15,430 --> 00:05:13,120
of the priority science questions that

131
00:05:17,670 --> 00:05:15,440
would form the structure of our report

132
00:05:19,909 --> 00:05:17,680
which again was organized by priority

133
00:05:23,749 --> 00:05:19,919
science questions for the first time

134
00:05:28,629 --> 00:05:26,150
activity of the steering group and what

135
00:05:30,950 --> 00:05:28,639
you see on the screen now are

136
00:05:32,950 --> 00:05:30,960
the 12 priority science questions that

137
00:05:35,430 --> 00:05:32,960
were ultimately identified by the

138
00:05:37,350 --> 00:05:35,440

committee they're grouped into three

139
00:05:39,510 --> 00:05:37,360
scientific themes

140
00:05:40,950 --> 00:05:39,520
the first is origins

141
00:05:42,230 --> 00:05:40,960
and this covers

142
00:05:44,950 --> 00:05:42,240
uh three

143
00:05:47,270 --> 00:05:44,960
scientific uh questions or that as we've

144
00:05:49,990 --> 00:05:47,280
defined them evolution of the proter

145
00:05:52,150 --> 00:05:50,000
protoplanetary disk the formation of

146
00:05:54,950 --> 00:05:52,160
planetary building blocks accretion in

147
00:05:58,309 --> 00:05:54,960
the outer solar system origin of earth

148
00:05:59,430 --> 00:05:58,319
and the inner solar system bodies

149
00:06:01,430 --> 00:05:59,440
theme b

150
00:06:03,909 --> 00:06:01,440
worlds and processes

151
00:06:05,909 --> 00:06:03,919
relates to the diversity of objects we

152
00:06:07,830 --> 00:06:05,919
see in the solar system today and the

153
00:06:09,590 --> 00:06:07,840
processes that have affected and

154
00:06:12,710 --> 00:06:09,600
continue to affect them in some cases

155
00:06:15,029 --> 00:06:12,720
today since the primordial time

156
00:06:18,870 --> 00:06:15,039
this spans impacts and dynamics solid

157
00:06:21,350 --> 00:06:18,880
body interior surfaces atmospheres

158
00:06:24,110 --> 00:06:21,360
climate uh giant planet structure and

159
00:06:26,790 --> 00:06:24,120
evolution and the uniquely coupled

160
00:06:27,990 --> 00:06:26,800
circumplanetary systems

161
00:06:29,830 --> 00:06:28,000
theme c

162
00:06:33,430 --> 00:06:29,840
life and habitability

163
00:06:34,629 --> 00:06:33,440

has three priority science questions

164
00:06:37,909 --> 00:06:34,639
the

165
00:06:39,590 --> 00:06:37,919
issue of how life on earth originated

166
00:06:42,550 --> 00:06:39,600
and evolved

167
00:06:46,629 --> 00:06:42,560
the concept of habitability

168
00:06:48,870 --> 00:06:46,639
in including how it can change with time

169
00:06:51,430 --> 00:06:48,880
and finally question 11

170
00:06:54,070 --> 00:06:51,440
relates to the search for life elsewhere

171
00:06:56,390 --> 00:06:54,080
beyond earth and our solar system

172
00:06:58,950 --> 00:06:56,400
question 12 is a cross-cutting question

173
00:07:02,309 --> 00:06:58,960
on exoplanets we say it's cross-setting

174
00:07:04,150 --> 00:07:02,319
because it relates to all of our other

175
00:07:06,629 --> 00:07:04,160
themes

176
00:07:08,150 --> 00:07:06,639
so for each of these 12

177
00:07:10,469 --> 00:07:08,160
science questions there's an

178
00:07:12,629 --> 00:07:10,479
accompanying chapter in the report there

179
00:07:14,550 --> 00:07:12,639
are substantial chapters and indeed the

180
00:07:17,670 --> 00:07:14,560
science question chapters

181
00:07:19,110 --> 00:07:17,680
comprise roughly the first 350 pages of

182
00:07:21,270 --> 00:07:19,120
the report

183
00:07:24,550 --> 00:07:21,280
so each of these chapters was written by

184
00:07:26,790 --> 00:07:24,560
a dedicated writing group and they

185
00:07:28,309 --> 00:07:26,800
have a common format

186
00:07:31,189 --> 00:07:28,319
they start off with the priority

187
00:07:34,309 --> 00:07:31,199
question then they identify

188
00:07:36,230 --> 00:07:34,319

the major typically half dozen

189
00:07:38,230 --> 00:07:36,240
sub questions

190
00:07:40,550 --> 00:07:38,240
that are the most important ones

191
00:07:42,390 --> 00:07:40,560
currently

192
00:07:44,309 --> 00:07:42,400
but the report goes beyond just

193
00:07:46,070 --> 00:07:44,319
identifying the questions and sub

194
00:07:48,309 --> 00:07:46,080
questions that we want to see answered

195
00:07:50,790 --> 00:07:48,319
for each of those main sub questions the

196
00:07:52,869 --> 00:07:50,800
report also identifies specific

197
00:07:55,670 --> 00:07:52,879
strategic research

198
00:07:58,230 --> 00:07:55,680
activities that would be of highest

199
00:08:00,070 --> 00:07:58,240
priority for advancing our understanding

200
00:08:02,950 --> 00:08:00,080
or answering that question in the next

201
00:08:05,670 --> 00:08:02,960
decade so the strategic research

202
00:08:07,430 --> 00:08:05,680
these are particular data observations

203
00:08:10,469 --> 00:08:07,440
theoretical models

204
00:08:12,390 --> 00:08:10,479
laboratory or experimental work needed

205
00:08:14,710 --> 00:08:12,400
so we hope these science questions in

206
00:08:16,710 --> 00:08:14,720
addition to uh providing the

207
00:08:18,390 --> 00:08:16,720
intellectual foundation for our

208
00:08:21,430 --> 00:08:18,400
prioritizations within the decadal

209
00:08:23,430 --> 00:08:21,440
survey will also be be a broad use to

210
00:08:27,110 --> 00:08:23,440
the community allowing researchers for

211
00:08:29,749 --> 00:08:27,120
example to immediately couple specific

212
00:08:34,469 --> 00:08:29,759
observations or modeling efforts back to

213
00:08:39,990 --> 00:08:37,829

so once we had drafted these 12 chapters

214
00:08:42,709 --> 00:08:40,000
and you looked at them as a group there

215
00:08:44,949 --> 00:08:42,719
were a handful of key high-level themes

216
00:08:46,310 --> 00:08:44,959
that emerged that i'll

217
00:08:49,350 --> 00:08:46,320
list here

218
00:08:52,070 --> 00:08:49,360
the first is the crucial role of both

219
00:08:55,350 --> 00:08:52,080
sample return and in-situ analysis for

220
00:08:58,070 --> 00:08:55,360
providing breakthrough of science and

221
00:09:00,310 --> 00:08:58,080
ground truth constraints

222
00:09:02,710 --> 00:09:00,320
the relative dearth of knowledge of our

223
00:09:06,389 --> 00:09:02,720
ice giant systems

224
00:09:09,110 --> 00:09:06,399
especially in light of our knowledge now

225
00:09:11,030 --> 00:09:09,120
that they may be the most common type of

226
00:09:13,269 --> 00:09:11,040
planet in the universe

227
00:09:15,190 --> 00:09:13,279
the importance of primordial processes

228
00:09:16,870 --> 00:09:15,200
to establishing initial compositional

229
00:09:18,710 --> 00:09:16,880
reservoirs in the disk the planetary

230
00:09:21,030 --> 00:09:18,720
building blocks the early dynamical

231
00:09:22,790 --> 00:09:21,040
evolution of solar system and of course

232
00:09:23,670 --> 00:09:22,800
the extensive

233
00:09:29,990 --> 00:09:23,680
and

234
00:09:31,829 --> 00:09:30,000
worlds we see

235
00:09:33,670 --> 00:09:31,839
central importance understanding the

236
00:09:35,829 --> 00:09:33,680
varied evolutionary paths of our

237
00:09:37,910 --> 00:09:35,839
terrestrial planets and the central

238
00:09:40,150 --> 00:09:37,920

question of how life on earth emerged

239
00:09:42,150 --> 00:09:40,160
and evolved and the compelling rationale

240
00:09:44,710 --> 00:09:42,160
to study habitable

241
00:09:46,550 --> 00:09:44,720
environments on mars and at icy ocean

242
00:09:48,870 --> 00:09:46,560
worlds in particular

243
00:09:51,030 --> 00:09:48,880
and finally the desire this decade to

244
00:09:52,470 --> 00:09:51,040
make substantial progress

245
00:09:54,150 --> 00:09:52,480
in actual

246
00:09:55,670 --> 00:09:54,160
life detection

247
00:09:58,790 --> 00:09:55,680
at um

248
00:10:00,870 --> 00:09:58,800
locales beyond earth in the solar system

249
00:10:03,110 --> 00:10:00,880
to determine whether or not we have

250
00:10:07,269 --> 00:10:03,120
evidence for past or existing life

251
00:10:10,230 --> 00:10:09,350
i mentioned that

252
00:10:11,910 --> 00:10:10,240
we

253
00:10:15,750 --> 00:10:11,920
treated state of profession for the

254
00:10:17,910 --> 00:10:15,760
first time in our field in our survey

255
00:10:19,910 --> 00:10:17,920
so i'll talk a little bit about our

256
00:10:22,310 --> 00:10:19,920
findings in that regard because we see

257
00:10:25,910 --> 00:10:22,320
them as broadly applicable across all of

258
00:10:30,790 --> 00:10:28,310
the committee identified the core

259
00:10:32,870 --> 00:10:30,800
principles listed below the first being

260
00:10:35,350 --> 00:10:32,880
that broad access and participation is

261
00:10:38,069 --> 00:10:35,360
simply essential to to excellence in our

262
00:10:41,269 --> 00:10:38,079
field to the degree that we don't have

263
00:10:45,350 --> 00:10:41,279

those things we are missing out on

264
00:10:47,350 --> 00:10:45,360
talent great people and great ideas

265
00:10:49,990 --> 00:10:47,360
we find that substantial evidence shows

266
00:10:51,509 --> 00:10:50,000
that implicit implicit biases can affect

267
00:10:53,350 --> 00:10:51,519
people's judgments

268
00:10:55,110 --> 00:10:53,360
even among those that are sincerely

269
00:10:57,829 --> 00:10:55,120
committed to equal opportunity and

270
00:11:00,389 --> 00:10:57,839
treatment and this motivates uh

271
00:11:04,230 --> 00:11:00,399
implementing processes to mitigate to

272
00:11:06,150 --> 00:11:04,240
mitigate the effect of such biases

273
00:11:08,310 --> 00:11:06,160
we found that implementing objective

274
00:11:10,630 --> 00:11:08,320
measures of self-examination

275
00:11:12,949 --> 00:11:10,640
in terms of the state of our field the

276
00:11:15,110 --> 00:11:12,959
state of our profession are needed to

277
00:11:16,949 --> 00:11:15,120
support deia improvement and build

278
00:11:18,310 --> 00:11:16,959
community trust and that we need a

279
00:11:20,790 --> 00:11:18,320
strong system of equity and

280
00:11:22,870 --> 00:11:20,800
accountability to recruit retain and

281
00:11:25,590 --> 00:11:22,880
nurture the best talent in our field

282
00:11:27,110 --> 00:11:25,600
which of course is what we all want

283
00:11:28,710 --> 00:11:27,120
here are some of the main state of

284
00:11:30,790 --> 00:11:28,720
profession findings

285
00:11:32,870 --> 00:11:30,800
the report acknowledges that substantial

286
00:11:34,710 --> 00:11:32,880
progress has been made

287
00:11:35,829 --> 00:11:34,720
in particular with respect to the entry

288
00:11:37,910 --> 00:11:35,839

and prominence of women in the

289
00:11:39,829 --> 00:11:37,920
profession however as shown in the

290
00:11:41,509 --> 00:11:39,839
bottom plot on the right much work

291
00:11:43,350 --> 00:11:41,519
remains particularly to address

292
00:11:46,389 --> 00:11:43,360
persistent and troubling issues of

293
00:11:48,310 --> 00:11:46,399
representation by race and ethnicity

294
00:11:50,470 --> 00:11:48,320
the report calls out the implementation

295
00:11:53,030 --> 00:11:50,480
of the dual anonymous peer review

296
00:11:55,829 --> 00:11:53,040
process at space telescope as a model

297
00:11:58,710 --> 00:11:55,839
for improving processes to mitigate bias

298
00:12:00,470 --> 00:11:58,720
and noted that work-life balance balance

299
00:12:02,069 --> 00:12:00,480
issues are a major

300
00:12:03,829 --> 00:12:02,079
negative factor

301
00:12:07,190 --> 00:12:03,839
in particular for

302
00:12:09,190 --> 00:12:07,200
different subgroups in our community

303
00:12:10,870 --> 00:12:09,200
we have four main state of profession

304
00:12:13,030 --> 00:12:10,880
recommendations throughout this talk

305
00:12:15,750 --> 00:12:13,040
you'll see the recommendations from the

306
00:12:17,670 --> 00:12:15,760
report paraphrased within these yellow

307
00:12:19,190 --> 00:12:17,680
boxes

308
00:12:20,949 --> 00:12:19,200
the first theme for our state of

309
00:12:23,509 --> 00:12:20,959
profession recommendations was what we

310
00:12:25,829 --> 00:12:23,519
call an evidence gathering imperative

311
00:12:27,590 --> 00:12:25,839
that's a directive to our sponsors to

312
00:12:29,829 --> 00:12:27,600
place a priority on obtaining the

313
00:12:31,990 --> 00:12:29,839

information currently lacking on the

314
00:12:34,230 --> 00:12:32,000
state of our field and the climate

315
00:12:37,110 --> 00:12:34,240
in that field and these are things

316
00:12:39,110 --> 00:12:37,120
essential to dei improvement

317
00:12:40,629 --> 00:12:39,120
the second relates to the education of

318
00:12:43,670 --> 00:12:40,639
individuals and the improvement of

319
00:12:45,030 --> 00:12:43,680
processes to deal with bias

320
00:12:48,150 --> 00:12:45,040
the third

321
00:12:50,550 --> 00:12:48,160
set of four recommendations address

322
00:12:53,030 --> 00:12:50,560
broadening opportunities

323
00:12:54,389 --> 00:12:53,040
to increase the involvement of

324
00:12:58,150 --> 00:12:54,399
underrepresented communities in our

325
00:13:00,230 --> 00:12:58,160
field and the fourth to uh sustaining

326
00:13:03,670 --> 00:13:00,240
and ensuring a community free of

327
00:13:05,829 --> 00:13:03,680
hostility and harassment

328
00:13:07,670 --> 00:13:05,839
so we have a whole chapter in the report

329
00:13:10,470 --> 00:13:07,680
on state of profession

330
00:13:14,629 --> 00:13:10,480
it's followed by an entire chapter on

331
00:13:15,910 --> 00:13:14,639
the topic of basic research and analysis

332
00:13:18,949 --> 00:13:15,920
the report

333
00:13:20,870 --> 00:13:18,959
makes a strong case that it is the basic

334
00:13:22,790 --> 00:13:20,880
research that takes these amazing

335
00:13:25,910 --> 00:13:22,800
results from the space missions that we

336
00:13:27,990 --> 00:13:25,920
do and translates those into an actual

337
00:13:29,829 --> 00:13:28,000
increase in the state of knowledge which

338
00:13:32,310 --> 00:13:29,839

fundamentally is the reason

339
00:13:34,470 --> 00:13:32,320
for what we do

340
00:13:36,870 --> 00:13:34,480
among all of the rna activities the

341
00:13:39,990 --> 00:13:36,880
report highlights the openly competed

342
00:13:41,670 --> 00:13:40,000
rna programs as the most impactful and

343
00:13:44,069 --> 00:13:41,680
efficient

344
00:13:46,310 --> 00:13:44,079
that they are openly competed ensures

345
00:13:48,470 --> 00:13:46,320
broad access and supports entry in the

346
00:13:50,550 --> 00:13:48,480
field and deia they're highly

347
00:13:52,710 --> 00:13:50,560
competitive as all of us know and that

348
00:13:55,910 --> 00:13:52,720
drives innovation

349
00:13:59,030 --> 00:13:55,920
and the rna program is also very

350
00:14:03,430 --> 00:13:59,040
flexible in its ability to respond uh to

351
00:14:06,069 --> 00:14:03,440
changing uh science and priorities

352
00:14:07,670 --> 00:14:06,079
the planetary program at nasa shown in

353
00:14:10,389 --> 00:14:07,680
the upper right plot has had an

354
00:14:11,670 --> 00:14:10,399
extraordinary past decade you can see

355
00:14:13,110 --> 00:14:11,680
the colored

356
00:14:15,750 --> 00:14:13,120
charts showing the growth and the

357
00:14:17,750 --> 00:14:15,760
overall size of the budget approximately

358
00:14:20,710 --> 00:14:17,760
doubling in the past decade

359
00:14:23,269 --> 00:14:20,720
the investment in rna per year has

360
00:14:26,150 --> 00:14:23,279
remained relatively flat when adjusted

361
00:14:28,629 --> 00:14:26,160
for inflation the net result of that is

362
00:14:31,030 --> 00:14:28,639
that the fractional investment in rna

363
00:14:33,910 --> 00:14:31,040

over the decade shown by the red line

364
00:14:36,550 --> 00:14:33,920
has decreased from about 15 percent down

365
00:14:38,069 --> 00:14:36,560
to about 8 percent currently

366
00:14:40,710 --> 00:14:38,079
along with that as shown in the bottom

367
00:14:42,629 --> 00:14:40,720
plot has been a growing field associated

368
00:14:44,550 --> 00:14:42,639
with the growing number of activities in

369
00:14:47,189 --> 00:14:44,560
our field an increasing number of

370
00:14:49,110 --> 00:14:47,199
proposals and a decreasing selection

371
00:14:51,030 --> 00:14:49,120
rate which has been at our lower or

372
00:14:53,189 --> 00:14:51,040
below 20 percent for the last several

373
00:14:55,430 --> 00:14:53,199
years and in this section the

374
00:14:57,750 --> 00:14:55,440
astrobiology programs are specifically

375
00:14:59,269 --> 00:14:57,760
called out as having a quite low

376
00:15:01,590 --> 00:14:59,279
selection rate

377
00:15:04,470 --> 00:15:01,600
so our main rna recommendation is that

378
00:15:06,949 --> 00:15:04,480
this trend of decreasing proportionate

379
00:15:09,910 --> 00:15:06,959
investment in basic research really

380
00:15:12,710 --> 00:15:09,920
needs to be addressed to sustain and

381
00:15:14,230 --> 00:15:12,720
promote our field going forward that it

382
00:15:17,110 --> 00:15:14,240
should be

383
00:15:19,350 --> 00:15:17,120
a minimum of 10 percent of the planetary

384
00:15:21,110 --> 00:15:19,360
science directorate budget per division

385
00:15:23,350 --> 00:15:21,120
budget per year should be invested in

386
00:15:26,069 --> 00:15:23,360
rna and that this increase should be

387
00:15:28,310 --> 00:15:26,079
achieved by a progressive ramp up in the

388
00:15:29,749 --> 00:15:28,320

funding allocated to the openly competed

389
00:15:32,069 --> 00:15:29,759
programs

390
00:15:34,230 --> 00:15:32,079
there are many other recommendations in

391
00:15:38,069 --> 00:15:34,240
this chapter as well that relate to the

392
00:15:43,269 --> 00:15:38,079
large programs including icar as well as

393
00:15:46,949 --> 00:15:45,030
astrobiology it's in the title of our

394
00:15:49,509 --> 00:15:46,959
decadal survey of course as you can see

395
00:15:51,189 --> 00:15:49,519
it's it figured prominently in our

396
00:15:54,069 --> 00:15:51,199
prioritizations

397
00:15:55,990 --> 00:15:54,079
it is three of the 12 priority science

398
00:15:57,990 --> 00:15:56,000
questions with a heavy emphasis of

399
00:15:58,870 --> 00:15:58,000
course in the exoplanets question as

400
00:16:01,670 --> 00:15:58,880
well

401
00:16:05,110 --> 00:16:01,680
and as you will see is a central goal of

402
00:16:07,030 --> 00:16:05,120
many of our current and planned missions

403
00:16:09,590 --> 00:16:07,040
in the boxes here are three specific

404
00:16:11,990 --> 00:16:09,600
recommendations from the prior national

405
00:16:13,910 --> 00:16:12,000
academies astrobiology strategy for

406
00:16:15,269 --> 00:16:13,920
search for life in the universe report

407
00:16:17,990 --> 00:16:15,279
the first related to dynamic

408
00:16:20,310 --> 00:16:18,000
habitability the second

409
00:16:23,829 --> 00:16:20,320
emphasizing the importance of study of

410
00:16:25,749 --> 00:16:23,839
subsurface life and the third a specific

411
00:16:27,509 --> 00:16:25,759
call for nasa to accelerate the

412
00:16:31,670 --> 00:16:27,519
development and validation of

413
00:16:35,350 --> 00:16:33,670

speaking to that last budget at that

414
00:16:36,710 --> 00:16:35,360
last bullet

415
00:16:39,430 --> 00:16:36,720
we have a

416
00:16:41,590 --> 00:16:39,440
a chapter in the report

417
00:16:43,509 --> 00:16:41,600
devoted to a discussion of technology

418
00:16:44,790 --> 00:16:43,519
development it's a beautifully written

419
00:16:45,749 --> 00:16:44,800
chapter

420
00:16:47,829 --> 00:16:45,759
i've

421
00:16:49,670 --> 00:16:47,839
excerpt a couple quotes related in

422
00:16:51,670 --> 00:16:49,680
particular to

423
00:16:54,389 --> 00:16:51,680
development of life detection

424
00:16:56,230 --> 00:16:54,399
technologies and the important to it the

425
00:16:58,470 --> 00:16:56,240
importance to integrate

426
00:17:00,069 --> 00:16:58,480
those approaches with

427
00:17:01,590 --> 00:17:00,079
sample acquisition handling and

428
00:17:04,630 --> 00:17:01,600
pre-processing

429
00:17:06,549 --> 00:17:04,640
system design to enable a single sample

430
00:17:08,390 --> 00:17:06,559
to be

431
00:17:10,470 --> 00:17:08,400
studied with multiple different life

432
00:17:13,189 --> 00:17:10,480
detection techniques

433
00:17:15,350 --> 00:17:13,199
the overall technology recommendations

434
00:17:18,309 --> 00:17:15,360
you can see the main one being that nasa

435
00:17:20,390 --> 00:17:18,319
should strive to invest a consistent six

436
00:17:22,470 --> 00:17:20,400
to eight percent of its budget in

437
00:17:25,590 --> 00:17:22,480
technology development and that it

438
00:17:28,710 --> 00:17:25,600

should have a technology program plan

439
00:17:30,310 --> 00:17:28,720
that both has a strategy and

440
00:17:32,310 --> 00:17:30,320
is

441
00:17:36,230 --> 00:17:32,320
transparent the community and that has a

442
00:17:41,029 --> 00:17:38,150
okay so now i'm going to turn to talking

443
00:17:43,909 --> 00:17:41,039
about uh planetary missions

444
00:17:46,230 --> 00:17:43,919
uh we have two flagships uh what we call

445
00:17:48,310 --> 00:17:46,240
the large the large missions underway

446
00:17:50,710 --> 00:17:48,320
right now the first being europa clipper

447
00:17:52,549 --> 00:17:50,720
an amazing mission that is scheduled to

448
00:17:54,710 --> 00:17:52,559
launch in 2024

449
00:17:56,710 --> 00:17:54,720
focused investigation of this amazing

450
00:17:58,310 --> 00:17:56,720
ocean world i'm sure you're all familiar

451
00:18:00,630 --> 00:17:58,320
with this incredible object it'll

452
00:18:02,310 --> 00:18:00,640
provide the critical foundation for our

453
00:18:05,669 --> 00:18:02,320
understanding of ocean worlds and their

454
00:18:07,590 --> 00:18:05,679
habitability and we recommend that we

455
00:18:10,630 --> 00:18:07,600
strongly support this and recommend nasa

456
00:18:11,830 --> 00:18:10,640
continue development of this mission

457
00:18:14,710 --> 00:18:11,840
the second

458
00:18:17,190 --> 00:18:14,720
large mission currently underway is mars

459
00:18:19,270 --> 00:18:17,200
sample return the perseverance rover

460
00:18:22,549 --> 00:18:19,280
shown on the upper right image is

461
00:18:25,029 --> 00:18:22,559
currently selecting and caching samples

462
00:18:26,950 --> 00:18:25,039
at mars mars sample return will bring

463
00:18:29,270 --> 00:18:26,960

those back to earth

464
00:18:31,669 --> 00:18:29,280
the top bullets talk about why the

465
00:18:34,310 --> 00:18:31,679
samples from mars are so

466
00:18:35,830 --> 00:18:34,320
important uh to our understanding of

467
00:18:37,990 --> 00:18:35,840
primordial terrestrial planets and

468
00:18:40,549 --> 00:18:38,000
astrobiology in particular you will hear

469
00:18:44,230 --> 00:18:40,559
more about that in the plenary talk

470
00:18:45,750 --> 00:18:44,240
tomorrow morning by professor mini wadwa

471
00:18:46,789 --> 00:18:45,760
but in short

472
00:18:49,830 --> 00:18:46,799
mars

473
00:18:51,430 --> 00:18:49,840
has a unique a uniquely preserved

474
00:18:54,310 --> 00:18:51,440
primordial

475
00:18:55,350 --> 00:18:54,320
early sedimentary record

476
00:18:57,909 --> 00:18:55,360
and

477
00:19:01,590 --> 00:18:57,919
it really is a

478
00:19:03,990 --> 00:19:01,600
a unique opportunity to access uh the to

479
00:19:05,909 --> 00:19:04,000
access uh information on the early

480
00:19:08,070 --> 00:19:05,919
conditions in the solar system uh

481
00:19:11,110 --> 00:19:08,080
prebiotic conditions in chemistry and

482
00:19:14,470 --> 00:19:11,120
perhaps of course also search for life

483
00:19:17,190 --> 00:19:14,480
the report found that msr should be the

484
00:19:18,710 --> 00:19:17,200
highest priority of nasa going forward

485
00:19:21,909 --> 00:19:18,720
and it should be completed as soon as

486
00:19:27,990 --> 00:19:24,470
there's a lot of support for the general

487
00:19:31,909 --> 00:19:28,000
mars exploration program in the report

488
00:19:35,350 --> 00:19:31,919

and for a ramp up of that program

489
00:19:37,590 --> 00:19:35,360
back to its pre-msr levels once the peak

490
00:19:39,510 --> 00:19:37,600
spending of msr has passed

491
00:19:41,669 --> 00:19:39,520
and in particular we recommend that the

492
00:19:43,750 --> 00:19:41,679
next medium class mission in that

493
00:19:47,590 --> 00:19:43,760
program be a mission

494
00:19:49,990 --> 00:19:47,600
like a mars life explorer this would

495
00:19:52,789 --> 00:19:50,000
characterize habitability of low

496
00:19:54,310 --> 00:19:52,799
latitude ice and look for modern bio

497
00:19:57,029 --> 00:19:54,320
signatures

498
00:19:57,830 --> 00:19:57,039
in addition to evaluating

499
00:20:02,630 --> 00:19:57,840
the

500
00:20:06,950 --> 00:20:02,640
that lead to its creation and sustain

501
00:20:12,390 --> 00:20:09,510
moving on now to the relationship

502
00:20:15,110 --> 00:20:12,400
between human exploration and science

503
00:20:17,990 --> 00:20:15,120
the committee prioritizes what we think

504
00:20:20,710 --> 00:20:18,000
is a really exciting groundbreaking

505
00:20:23,110 --> 00:20:20,720
human robotic partnership at the moon

506
00:20:24,390 --> 00:20:23,120
the endurance a mission

507
00:20:26,230 --> 00:20:24,400
in general

508
00:20:27,990 --> 00:20:26,240
detailed in a whole chapter on human

509
00:20:31,430 --> 00:20:28,000
exploration our report

510
00:20:33,909 --> 00:20:31,440
we find that the human exploration plans

511
00:20:35,750 --> 00:20:33,919
moon to mars are aspirational

512
00:20:38,549 --> 00:20:35,760
inspirational and we argue that they

513
00:20:40,149 --> 00:20:38,559

should be accompanied by a

514
00:20:42,149 --> 00:20:40,159
transformative

515
00:20:44,310 --> 00:20:42,159
scientific component

516
00:20:46,070 --> 00:20:44,320
that will provide a rationale for

517
00:20:47,830 --> 00:20:46,080
sustained human exploration and

518
00:20:49,029 --> 00:20:47,840
activities so you can see in that top

519
00:20:51,350 --> 00:20:49,039
box

520
00:20:53,750 --> 00:20:51,360
our main overall recommendation that the

521
00:20:55,750 --> 00:20:53,760
artemis human exploration program

522
00:21:04,950 --> 00:20:55,760
should advance high priority lunar

523
00:21:04,960 --> 00:21:08,950
in particular we recommend

524
00:21:13,909 --> 00:21:11,510
that the lunar discovery and exploration

525
00:21:15,669 --> 00:21:13,919
program make as its highest priority in

526
00:21:17,510 --> 00:21:15,679
the next decade

527
00:21:18,789 --> 00:21:17,520
enacting a medium-class mission

528
00:21:20,950 --> 00:21:18,799
endurance a

529
00:21:22,549 --> 00:21:20,960
this would be a lunar rover that would

530
00:21:24,789 --> 00:21:22,559
be robotically delivered to the moon's

531
00:21:26,870 --> 00:21:24,799
surface and then undergo a large of

532
00:21:29,430 --> 00:21:26,880
order thousand kilometer traverse

533
00:21:31,350 --> 00:21:29,440
collecting carefully selected samples

534
00:21:33,110 --> 00:21:31,360
along the way and return those samples

535
00:21:35,750 --> 00:21:33,120
to where they can be picked up and

536
00:21:37,830 --> 00:21:35,760
returned to earth by the astronauts and

537
00:21:39,909 --> 00:21:37,840
we argue that this would be the ideal

538
00:21:42,070 --> 00:21:39,919

synergy between nasa's

539
00:21:45,669 --> 00:21:42,080
historic artemis

540
00:21:47,990 --> 00:21:45,679
human exploration effort and conducting

541
00:21:50,630 --> 00:21:48,000
transformative breakthrough science

542
00:21:53,029 --> 00:21:50,640
about not only the moon but the early

543
00:21:55,990 --> 00:21:53,039
history of the solar system recorded in

544
00:21:57,830 --> 00:21:56,000
its most ancient impact basin south pole

545
00:22:00,230 --> 00:21:57,840
aiken

546
00:22:02,549 --> 00:22:00,240
move on to our new frontiers program

547
00:22:05,909 --> 00:22:02,559
those are our medium class missions

548
00:22:08,789 --> 00:22:05,919
that are pi led but but each mission

549
00:22:11,590 --> 00:22:08,799
proposal has to address one of a list of

550
00:22:13,669 --> 00:22:11,600
pre-specified mission themes

551
00:22:15,830 --> 00:22:13,679
for the new frontier six

552
00:22:18,230 --> 00:22:15,840
call the committee prioritized eight

553
00:22:20,549 --> 00:22:18,240
themes and one additional theme for the

554
00:22:24,549 --> 00:22:20,559
new frontier seven call

555
00:22:28,870 --> 00:22:26,870
factors listed below the main one being

556
00:22:30,230 --> 00:22:28,880
their ability to address the priority

557
00:22:32,390 --> 00:22:30,240
science questions and produce

558
00:22:34,470 --> 00:22:32,400
breakthrough science

559
00:22:36,870 --> 00:22:34,480
so here are those themes

560
00:22:39,110 --> 00:22:36,880
these are just a phenomenal set of

561
00:22:42,310 --> 00:22:39,120
missions we're very excited by these

562
00:22:45,190 --> 00:22:42,320
alphabetical order um the top group

563
00:22:47,350 --> 00:22:45,200

upper left a centaur orbiter and lander

564
00:22:49,750 --> 00:22:47,360
centaurs or objects originally formed in

565
00:22:52,070 --> 00:22:49,760
the kuiper belt that now orbit in the

566
00:22:55,110 --> 00:22:52,080
giant planet region and are thought to

567
00:22:57,350 --> 00:22:55,120
be primordial objects

568
00:22:59,110 --> 00:22:57,360
series sample return ceres is the most

569
00:23:00,870 --> 00:22:59,120
ice rich object in the inner solar

570
00:23:03,990 --> 00:23:00,880
system it's a dwarf planet this would

571
00:23:06,470 --> 00:23:04,000
bring samples back from series for

572
00:23:08,070 --> 00:23:06,480
detailed uh compositional and isotopic

573
00:23:09,909 --> 00:23:08,080
analysis

574
00:23:11,990 --> 00:23:09,919
also another sample return mission a

575
00:23:13,750 --> 00:23:12,000
comet sample return of course these are

576
00:23:15,909 --> 00:23:13,760
highly evolved objects this would teach

577
00:23:18,950 --> 00:23:15,919
us about how they formed and evolved in

578
00:23:21,029 --> 00:23:18,960
addition to telling us more about how

579
00:23:24,230 --> 00:23:21,039
comets contributed

580
00:23:26,710 --> 00:23:24,240
organics and water to earth

581
00:23:29,590 --> 00:23:26,720
enceladus multiple flyby enceladus is a

582
00:23:32,070 --> 00:23:29,600
ma an amazing inner moon of saturn that

583
00:23:34,549 --> 00:23:32,080
has an active south polar region with

584
00:23:36,950 --> 00:23:34,559
plumes that are being ejected from its

585
00:23:38,710 --> 00:23:36,960
subsurface ocean this mission would fly

586
00:23:40,710 --> 00:23:38,720
through those plumes and sample them

587
00:23:43,110 --> 00:23:40,720
lunar geophysical network

588
00:23:44,710 --> 00:23:43,120

surface geophysical packages to teach us

589
00:23:47,669 --> 00:23:44,720
about the moon's bulk composition

590
00:23:50,390 --> 00:23:47,679
interior saturn probe to teach us about

591
00:23:52,390 --> 00:23:50,400
the composition and atmospheric

592
00:23:54,630 --> 00:23:52,400
properties of saturn that help constrain

593
00:23:56,710 --> 00:23:54,640
where and when it formed

594
00:23:59,029 --> 00:23:56,720
the titan orbiter we of course have the

595
00:24:01,190 --> 00:23:59,039
amazing dragonfly new frontiers mission

596
00:24:03,269 --> 00:24:01,200
underway this would be a complement to

597
00:24:05,190 --> 00:24:03,279
that this would be a global focused

598
00:24:07,190 --> 00:24:05,200
mission to look at the global climate

599
00:24:10,950 --> 00:24:07,200
and hydrological cycles as well as the

600
00:24:13,590 --> 00:24:10,960
interior of titan venus in situ explorer

601
00:24:15,990 --> 00:24:13,600
focusing in particular on surface and

602
00:24:18,789 --> 00:24:16,000
surface atmospheric interactions that

603
00:24:21,990 --> 00:24:18,799
can't be addressed by an orbiter a

604
00:24:24,470 --> 00:24:22,000
single atmospheric probe and finally

605
00:24:26,310 --> 00:24:24,480
triton ocean world surveyor neptune's

606
00:24:27,590 --> 00:24:26,320
irregular satellite triton is this

607
00:24:30,149 --> 00:24:27,600
amazing

608
00:24:33,029 --> 00:24:30,159
moon that may be an ocean world and we

609
00:24:35,430 --> 00:24:33,039
know has plumes and this mission would

610
00:24:37,590 --> 00:24:35,440
go into orbit around neptune and undergo

611
00:24:40,390 --> 00:24:37,600
many tens of flybys past this

612
00:24:42,950 --> 00:24:40,400
fascinating objects

613
00:24:44,789 --> 00:24:42,960

for our larger flagship class priorities

614
00:24:47,190 --> 00:24:44,799
for the next decade we considered six

615
00:24:49,430 --> 00:24:47,200
candidates shown here as all having

616
00:24:52,789 --> 00:24:49,440
exceptional scientific merit

617
00:24:54,149 --> 00:24:52,799
ultimately the ice giant orbiter and

618
00:24:56,230 --> 00:24:54,159
probe

619
00:24:59,190 --> 00:24:56,240
topic was judged to be the highest

620
00:25:01,430 --> 00:24:59,200
priority primarily for its ability to

621
00:25:03,590 --> 00:25:01,440
produce transformative science on a

622
00:25:05,350 --> 00:25:03,600
class of objects that's the only one

623
00:25:07,990 --> 00:25:05,360
that we haven't studied with a dedicated

624
00:25:10,549 --> 00:25:08,000
orbital tour in our solar system and

625
00:25:13,510 --> 00:25:10,559
again we now think that these mini

626
00:25:16,470 --> 00:25:13,520
neptunes to neptune-class planets are

627
00:25:18,789 --> 00:25:16,480
probably the most frequent frequently

628
00:25:21,830 --> 00:25:18,799
occurring planets in the universe

629
00:25:24,470 --> 00:25:21,840
another consideration here was that the

630
00:25:27,350 --> 00:25:24,480
multi-target

631
00:25:28,710 --> 00:25:27,360
system-wide emphasis of an ice giant

632
00:25:30,470 --> 00:25:28,720
orbiter and tour was seen as

633
00:25:32,549 --> 00:25:30,480
complementary as the to the current

634
00:25:34,470 --> 00:25:32,559
flagships with which focus on single

635
00:25:36,549 --> 00:25:34,480
objects

636
00:25:38,789 --> 00:25:36,559
we prioritize at the top priority the

637
00:25:40,549 --> 00:25:38,799
uranus orbiter and probe this would be

638
00:25:43,190 --> 00:25:40,559

an in-situ probe to the planet a

639
00:25:45,750 --> 00:25:43,200
multi-year orbital tour you can see the

640
00:25:49,269 --> 00:25:45,760
topics to be addressed in the

641
00:25:52,310 --> 00:25:49,279
here on the right uh the reason

642
00:25:54,950 --> 00:25:52,320
uh we we carefully evaluated both uranus

643
00:25:57,590 --> 00:25:54,960
and neptune as potential targets for an

644
00:26:00,230 --> 00:25:57,600
ice giant mission uranus one out for

645
00:26:02,230 --> 00:26:00,240
technical readiness issues at uranus we

646
00:26:04,390 --> 00:26:02,240
have a mission concept that's ready to

647
00:26:06,070 --> 00:26:04,400
start now no new technologies are

648
00:26:08,230 --> 00:26:06,080
required and we have

649
00:26:11,029 --> 00:26:08,240
viable trajectories on currently

650
00:26:13,190 --> 00:26:11,039
available launch vehicles in particular

651
00:26:17,510 --> 00:26:13,200
in our recommended budget

652
00:26:20,310 --> 00:26:17,520
we argue for the start in fy 24 of this

653
00:26:23,430 --> 00:26:20,320
mission to take advantage of a launch in

654
00:26:25,909 --> 00:26:23,440
2031 to 2032 that can use a jupiter

655
00:26:30,470 --> 00:26:25,919
gravity assist to get to uranus

656
00:26:35,909 --> 00:26:33,510
we also prioritize a second flagship the

657
00:26:37,909 --> 00:26:35,919
enceladus orbilander and this is to

658
00:26:39,590 --> 00:26:37,919
address the question is enceladus

659
00:26:41,990 --> 00:26:39,600
inhabited this is really a life

660
00:26:43,990 --> 00:26:42,000
detection focused mission

661
00:26:46,710 --> 00:26:44,000
the report argues that enceladus is the

662
00:26:48,710 --> 00:26:46,720
optimal locale to sample

663
00:26:50,789 --> 00:26:48,720

the subsurface ocean through freshly

664
00:26:53,830 --> 00:26:50,799
ejected material

665
00:26:55,909 --> 00:26:53,840
and you'll note that enceladus is the

666
00:26:57,430 --> 00:26:55,919
target of both our second priority

667
00:26:59,590 --> 00:26:57,440
flagship and it was on that new

668
00:27:01,350 --> 00:26:59,600
frontiers mission list i just described

669
00:27:03,029 --> 00:27:01,360
earlier

670
00:27:03,990 --> 00:27:03,039
ultimately the committee felt that the

671
00:27:06,390 --> 00:27:04,000
study

672
00:27:08,549 --> 00:27:06,400
of enceladus and life detection at

673
00:27:10,390 --> 00:27:08,559
enceladus was such a high priority that

674
00:27:13,190 --> 00:27:10,400
we wanted to provide two different

675
00:27:16,070 --> 00:27:13,200
alternatives for making progress on that

676
00:27:17,830 --> 00:27:16,080
topic during this decade so if orbi

677
00:27:20,630 --> 00:27:17,840
lander is initiated and of course we

678
00:27:22,710 --> 00:27:20,640
would love to get a second flagship then

679
00:27:24,549 --> 00:27:22,720
enceladus multiple flyby would then be

680
00:27:26,149 --> 00:27:24,559
removed from the new frontiers six and

681
00:27:27,669 --> 00:27:26,159
seven list

682
00:27:29,190 --> 00:27:27,679
so i wanted to speak

683
00:27:30,230 --> 00:27:29,200
for a moment

684
00:27:32,789 --> 00:27:30,240
about

685
00:27:36,070 --> 00:27:32,799
why the committee ended up prioritizing

686
00:27:38,230 --> 00:27:36,080
enceladus orbilander over europa lander

687
00:27:40,230 --> 00:27:38,240
europa being of course another

688
00:27:41,350 --> 00:27:40,240

incredibly scientifically compelling

689
00:27:43,669 --> 00:27:41,360
object

690
00:27:45,110 --> 00:27:43,679
there are two main reasons for this the

691
00:27:47,669 --> 00:27:45,120
first is

692
00:27:50,389 --> 00:27:47,679
what we know to be the accessibility of

693
00:27:53,430 --> 00:27:50,399
fresh material from the oceans at

694
00:27:55,510 --> 00:27:53,440
enceladus where we know we have well

695
00:27:57,909 --> 00:27:55,520
characterized plume activity it's

696
00:27:59,909 --> 00:27:57,919
continuous relatively large amount of

697
00:28:03,350 --> 00:27:59,919
material

698
00:28:05,669 --> 00:28:03,360
the second main factor is the benign

699
00:28:07,830 --> 00:28:05,679
radiation environment and enceladus

700
00:28:10,070 --> 00:28:07,840
which essentially allows for an order of

701
00:28:12,870 --> 00:28:10,080
magnitude longer mission

702
00:28:15,269 --> 00:28:12,880
to study and to try to detect life using

703
00:28:17,830 --> 00:28:15,279
multiple complementary techniques at

704
00:28:20,310 --> 00:28:17,840
europa after being in orbit around

705
00:28:22,230 --> 00:28:20,320
europa and flying through the plumes and

706
00:28:24,950 --> 00:28:22,240
sampling that way we can land on the

707
00:28:26,950 --> 00:28:24,960
surface and passively collect material

708
00:28:29,510 --> 00:28:26,960
as the plumes rain down on us in

709
00:28:31,590 --> 00:28:29,520
addition to having an active scoop

710
00:28:33,350 --> 00:28:31,600
in an overall mission that can last

711
00:28:35,750 --> 00:28:33,360
years

712
00:28:37,750 --> 00:28:35,760
so we're extremely excited about the

713
00:28:39,590 --> 00:28:37,760

prospects for orbee lander

714
00:28:42,230 --> 00:28:39,600
but i want to also

715
00:28:43,909 --> 00:28:42,240
do another call out for europa because

716
00:28:45,669 --> 00:28:43,919
we know that europa clipper is going to

717
00:28:49,110 --> 00:28:45,679
just be returning

718
00:28:51,190 --> 00:28:49,120
fantastic results and will transform our

719
00:28:53,190 --> 00:28:51,200
understanding of that object in the next

720
00:28:55,590 --> 00:28:53,200
decade as well

721
00:28:58,149 --> 00:28:55,600
let me finish by talking about some of

722
00:28:59,909 --> 00:28:58,159
our specific budgets one of our

723
00:29:01,990 --> 00:28:59,919
requirements and our statement of task

724
00:29:04,710 --> 00:29:02,000
is what we propose has to be achievable

725
00:29:07,110 --> 00:29:04,720
within realistic budgets we detailed two

726
00:29:09,990 --> 00:29:07,120
programs the level program which takes

727
00:29:11,909 --> 00:29:10,000
the fy 23 planetary science division

728
00:29:13,669 --> 00:29:11,919
budget and inflates it at two percent

729
00:29:15,430 --> 00:29:13,679
per year for the decade and a

730
00:29:17,750 --> 00:29:15,440
recommended program

731
00:29:19,909 --> 00:29:17,760
that increases the total budget across

732
00:29:21,510 --> 00:29:19,919
the decade by little less than 20

733
00:29:23,590 --> 00:29:21,520
percent

734
00:29:24,470 --> 00:29:23,600
the recommended program

735
00:29:28,230 --> 00:29:24,480
is

736
00:29:30,470 --> 00:29:28,240
really the one that hits all of the uh

737
00:29:32,470 --> 00:29:30,480
the goals of the survey and it's what we

738
00:29:34,549 --> 00:29:32,480

strongly recommend as the as the name

739
00:29:37,110 --> 00:29:34,559
implies but the level program we are

740
00:29:39,669 --> 00:29:37,120
very careful to prioritize funding to

741
00:29:41,590 --> 00:29:39,679
yield a balance really strong program

742
00:29:43,990 --> 00:29:41,600
even in that case

743
00:29:46,630 --> 00:29:44,000
in the recommended program here are key

744
00:29:49,029 --> 00:29:46,640
aspects to highlight a couple the uranus

745
00:29:50,710 --> 00:29:49,039
orbiter and probe gets initiated in fy

746
00:29:52,470 --> 00:29:50,720
24

747
00:29:53,190 --> 00:29:52,480
you can see a

748
00:29:57,590 --> 00:29:53,200
a

749
00:30:01,350 --> 00:29:57,600
two new frontier selections in new

750
00:30:05,110 --> 00:30:03,110
and the bottom point in particular

751
00:30:08,310 --> 00:30:05,120
initiates the second flagship um

752
00:30:10,630 --> 00:30:08,320
enceladus orbilander and fy29

753
00:30:12,230 --> 00:30:10,640
the level program does many of the same

754
00:30:15,110 --> 00:30:12,240
things those are shown in white the

755
00:30:17,430 --> 00:30:15,120
yellow points show you the differences

756
00:30:19,830 --> 00:30:17,440
the start of the new flagship is delayed

757
00:30:22,310 --> 00:30:19,840
there's no new start for orbeelander

758
00:30:24,789 --> 00:30:22,320
but again still an overall robust

759
00:30:26,710 --> 00:30:24,799
program

760
00:30:29,269 --> 00:30:26,720
so this is my final slide and then we'll

761
00:30:31,750 --> 00:30:29,279
hopefully have lots of time for q a

762
00:30:34,549 --> 00:30:31,760
after we had done our prioritization of

763
00:30:37,669 --> 00:30:34,559

missions we went back and created this

764
00:30:39,990 --> 00:30:37,679
traceability matrix of sorts to see how

765
00:30:43,029 --> 00:30:40,000
well they addressed our originally

766
00:30:46,070 --> 00:30:43,039
defined 12 priority science questions

767
00:30:47,430 --> 00:30:46,080
and you can see the result here

768
00:30:50,549 --> 00:30:47,440
once we had

769
00:30:53,269 --> 00:30:50,559
completed this exercise we thought that

770
00:30:55,510 --> 00:30:53,279
uh this suite of missions does an

771
00:30:57,509 --> 00:30:55,520
excellent job of addressing the breadth

772
00:30:59,190 --> 00:30:57,519
of the science questions

773
00:31:01,029 --> 00:30:59,200
but we do want to highlight that we

774
00:31:03,590 --> 00:31:01,039
didn't actually start with this matrix

775
00:31:05,750 --> 00:31:03,600
to prioritize our missions and that

776
00:31:08,630 --> 00:31:05,760
the boxes that are filled in should not

777
00:31:10,789 --> 00:31:08,640
be added up to prioritize one mission

778
00:31:13,590 --> 00:31:10,799
over another because indeed a mission

779
00:31:15,990 --> 00:31:13,600
that addresses just one question in a

780
00:31:19,029 --> 00:31:16,000
uniquely impactful way can be as

781
00:31:20,950 --> 00:31:19,039
important as another that addresses many

782
00:31:23,509 --> 00:31:20,960
so you can see

783
00:31:26,149 --> 00:31:23,519
the questions 9 through 12 really which

784
00:31:28,070 --> 00:31:26,159
is where most of the astrobiology

785
00:31:30,710 --> 00:31:28,080
emphasis lies

786
00:31:32,710 --> 00:31:30,720
are an important focus of our

787
00:31:34,389 --> 00:31:32,720
recommended portfolio for the next

788
00:31:35,909 --> 00:31:34,399

decade

789
00:31:38,950 --> 00:31:35,919
so those are

790
00:31:41,350 --> 00:31:38,960
those are our slides and

791
00:31:54,149 --> 00:31:41,360
looks like we'll have about 30 minutes

792
00:32:01,110 --> 00:31:59,110
yes hi uh sam howell jpl i just uh had a

793
00:32:02,310 --> 00:32:01,120
couple of thoughts on

794
00:32:03,909 --> 00:32:02,320
um

795
00:32:05,909 --> 00:32:03,919
this trade between

796
00:32:07,110 --> 00:32:05,919
enceladus and europa landers and some

797
00:32:08,549 --> 00:32:07,120
things i've been thinking about since

798
00:32:10,870 --> 00:32:08,559
the cable

799
00:32:12,950 --> 00:32:10,880
so you mentioned that one of the driving

800
00:32:14,389 --> 00:32:12,960
differentiators is that we understand

801
00:32:16,710 --> 00:32:14,399
fresh plum material is raining down the

802
00:32:18,070 --> 00:32:16,720
enceladus from the ocean but

803
00:32:19,909 --> 00:32:18,080
i i don't know that it's the community

804
00:32:21,830 --> 00:32:19,919
consensus that there is a direct and

805
00:32:23,430 --> 00:32:21,840
sustained connection to the ocean that

806
00:32:25,110 --> 00:32:23,440
results in rapid ascension right we have

807
00:32:28,149 --> 00:32:25,120
an idea that they're interrelated but

808
00:32:29,830 --> 00:32:28,159
magnetic plumbing is complicated and you

809
00:32:31,990 --> 00:32:29,840
mentioned the difficulty of europa's

810
00:32:33,590 --> 00:32:32,000
radiation environment but right that's

811
00:32:35,590 --> 00:32:33,600
precisely why we want to study europa

812
00:32:37,430 --> 00:32:35,600
because i o plus ice plus radiation

813
00:32:39,509 --> 00:32:37,440

makes oxidants a young surface brings

814
00:32:40,950 --> 00:32:39,519
stuff to reduced ocean

815
00:32:42,710 --> 00:32:40,960
and so as you mentioned we know that

816
00:32:44,549 --> 00:32:42,720
there's going to be fantastic science

817
00:32:46,389 --> 00:32:44,559
coming out of europa clipper but it

818
00:32:48,310 --> 00:32:46,399
seems like setting a

819
00:32:50,710 --> 00:32:48,320
sort of 30-year goal of landing on

820
00:32:52,470 --> 00:32:50,720
harder enceladus reduces our ability to

821
00:32:54,789 --> 00:32:52,480
respond to that science when we think

822
00:32:55,830 --> 00:32:54,799
about the best targets for landing

823
00:32:58,389 --> 00:32:55,840
including what we might learn about

824
00:33:00,630 --> 00:32:58,399
europa leagues and right so enceladus

825
00:33:02,149 --> 00:33:00,640
gets an additional new frontier study

826
00:33:05,110 --> 00:33:02,159
uh

827
00:33:07,509 --> 00:33:05,120
by the europa lander um

828
00:33:08,630 --> 00:33:07,519
flagship uh wasn't re-evaluated as

829
00:33:10,630 --> 00:33:08,640
weather

830
00:33:13,269 --> 00:33:10,640
in the new frontiers cost cap so i'm

831
00:33:15,830 --> 00:33:13,279
just wondering a little bit about um

832
00:33:17,990 --> 00:33:15,840
whether or not there is a path instead

833
00:33:20,230 --> 00:33:18,000
or continue trading the science

834
00:33:22,149 --> 00:33:20,240
because it seems like uh some of the

835
00:33:23,590 --> 00:33:22,159
best parts of the science for europa

836
00:33:25,430 --> 00:33:23,600
weren't given the same consideration as

837
00:33:27,669 --> 00:33:25,440
for enceladus and we have a flagship

838
00:33:30,549 --> 00:33:27,679

going there this thing

839
00:33:34,149 --> 00:33:30,559
um so i guess summarizing that into a

840
00:33:38,470 --> 00:33:36,310
when we think about uh

841
00:33:40,310 --> 00:33:38,480
the best targets for landing is at the

842
00:33:42,549 --> 00:33:40,320
conclusion of the decadal that as of

843
00:33:44,470 --> 00:33:42,559
today the science that we should use to

844
00:33:46,470 --> 00:33:44,480
you know guide 37 or 30 years of

845
00:33:48,389 --> 00:33:46,480
exploration is settled and points to

846
00:33:51,669 --> 00:33:48,399
enceladus or is there still room this

847
00:33:54,070 --> 00:33:51,679
decade to continue thinking about that

848
00:33:56,149 --> 00:33:54,080
okay well first of all you will you will

849
00:34:00,230 --> 00:33:56,159
get no argument from anyone on the

850
00:34:01,190 --> 00:34:00,240
committee about the inherent interest

851
00:34:04,070 --> 00:34:01,200
and

852
00:34:06,870 --> 00:34:04,080
amazing properties of europa okay this

853
00:34:09,990 --> 00:34:06,880
is an absolutely fantastic target

854
00:34:11,510 --> 00:34:10,000
everyone is thrilled to see what europa

855
00:34:13,430 --> 00:34:11,520
clipper is

856
00:34:14,790 --> 00:34:13,440
going to bring back in terms of

857
00:34:15,750 --> 00:34:14,800
understanding

858
00:34:19,030 --> 00:34:15,760
and

859
00:34:21,829 --> 00:34:19,040
these are both phenomenal ocean worlds

860
00:34:24,470 --> 00:34:21,839
as you note even though we have a lot of

861
00:34:27,829 --> 00:34:24,480
knowledge from cassini about enceladus

862
00:34:29,030 --> 00:34:27,839
in terms of plume location plume volume

863
00:34:38,470 --> 00:34:29,040

at

864
00:34:40,470 --> 00:34:38,480
have knowledge of the smaller organic

865
00:34:42,790 --> 00:34:40,480
molecules

866
00:34:44,950 --> 00:34:42,800
that knowledge is not complete

867
00:34:46,869 --> 00:34:44,960
but it's very compelling

868
00:34:48,550 --> 00:34:46,879
so it's that

869
00:34:50,629 --> 00:34:48,560
combined with

870
00:34:57,109 --> 00:34:50,639
the

871
00:35:00,390 --> 00:34:57,119
do have a pretty good handle on from

872
00:35:03,870 --> 00:35:00,400
cassini gravity and associated studies

873
00:35:06,069 --> 00:35:03,880
as well as the much longer mission

874
00:35:07,109 --> 00:35:06,079
survivability time

875
00:35:13,190 --> 00:35:07,119
that

876
00:35:15,670 --> 00:35:13,200
the basis of the committee's um thinking

877
00:35:18,390 --> 00:35:15,680
with that said

878
00:35:20,150 --> 00:35:18,400
every decadal is the assessment of the

879
00:35:22,470 --> 00:35:20,160
state of knowledge at the time the

880
00:35:24,790 --> 00:35:22,480
decadal survey is written you know in

881
00:35:26,069 --> 00:35:24,800
other areas we've already seen things

882
00:35:28,230 --> 00:35:26,079
happen

883
00:35:30,470 --> 00:35:28,240
that have changed relative to what we

884
00:35:32,230 --> 00:35:30,480
considered just since the middle of

885
00:35:34,470 --> 00:35:32,240
april okay

886
00:35:37,030 --> 00:35:34,480
so hopefully what we do with the decadal

887
00:35:39,510 --> 00:35:37,040
survey is we lay out the rationale the

888
00:35:42,310 --> 00:35:39,520

core rationale is the science the core

889
00:35:44,870 --> 00:35:42,320
rationale or the science questions okay

890
00:35:46,790 --> 00:35:44,880
and we make our prioritizations

891
00:35:49,750 --> 00:35:46,800
based on the state of knowledge of the

892
00:35:52,950 --> 00:35:49,760
time but as things evolve if we've done

893
00:35:54,710 --> 00:35:52,960
our job right those core science issues

894
00:35:58,069 --> 00:35:54,720
will still be there to provide a

895
00:35:59,750 --> 00:35:58,079
framework if needed by uh the change of

896
00:36:02,870 --> 00:35:59,760
events or a change in budgets or

897
00:36:05,109 --> 00:36:02,880
changing discoveries for things to uh to

898
00:36:06,790 --> 00:36:05,119
respond for instance we saw in the last

899
00:36:09,030 --> 00:36:06,800
decade right we didn't even have an

900
00:36:12,069 --> 00:36:09,040
ocean world's new frontiers theme from

901
00:36:14,390 --> 00:36:12,079
vision and voyages right that that was

902
00:36:17,030 --> 00:36:14,400
that was an addition in response to

903
00:36:18,470 --> 00:36:17,040
evolving scientific knowledge and

904
00:36:21,910 --> 00:36:18,480
excitement that happened during the

905
00:36:25,349 --> 00:36:21,920
decade so of course no decadal is meant

906
00:36:27,349 --> 00:36:25,359
to constrain things for 30 years and in

907
00:36:29,430 --> 00:36:27,359
fact if it's done well

908
00:36:33,030 --> 00:36:29,440
it will provide a framework to even

909
00:36:35,349 --> 00:36:33,040
within the decade if needed to

910
00:36:37,430 --> 00:36:35,359
allow our community and our sponsors to

911
00:36:38,829 --> 00:36:37,440
respond to those changes

912
00:36:42,630 --> 00:36:38,839
thank you i appreciate

913
00:36:43,750 --> 00:36:42,640

that yes hey robin morgan cable gpl

914
00:36:45,510 --> 00:36:43,760
thank you so much for giving this

915
00:36:47,670 --> 00:36:45,520
briefing and thank you also for your

916
00:36:48,790 --> 00:36:47,680
service and in leading the survey thank

917
00:36:50,950 --> 00:36:48,800
you

918
00:36:52,310 --> 00:36:50,960
i have a another question about ocean

919
00:36:54,150 --> 00:36:52,320
worlds if you're willing to entertain

920
00:36:56,950 --> 00:36:54,160
one more yeah i was wondering if you

921
00:36:59,270 --> 00:36:56,960
could clarify a bit the plan for

922
00:37:01,829 --> 00:36:59,280
enceladus you had mentioned that it was

923
00:37:03,190 --> 00:37:01,839
important to keep both options open of

924
00:37:06,310 --> 00:37:03,200
new frontiers

925
00:37:08,710 --> 00:37:06,320
and flagship and that if the flagship

926
00:37:10,230 --> 00:37:08,720
did receive a new start that enceladus

927
00:37:12,550 --> 00:37:10,240
would be removed from the new frontiers

928
00:37:14,870 --> 00:37:12,560
list my question is what if the converse

929
00:37:16,550 --> 00:37:14,880
happens what if the enceladus multiple

930
00:37:19,109 --> 00:37:16,560
flyby mission is selected for new

931
00:37:22,230 --> 00:37:19,119
frontiers five what does that mean for

932
00:37:26,550 --> 00:37:24,069
that's a very good question

933
00:37:29,030 --> 00:37:26,560
and i think that um

934
00:37:31,750 --> 00:37:29,040
uh you know that would be it's not

935
00:37:32,790 --> 00:37:31,760
actually specifically addressed in our

936
00:37:37,270 --> 00:37:32,800
report

937
00:37:39,349 --> 00:37:37,280
um we we thought that the um

938
00:37:41,030 --> 00:37:39,359

the trajectory

939
00:37:42,710 --> 00:37:41,040
of the decadal

940
00:37:47,910 --> 00:37:42,720
budget

941
00:37:50,390 --> 00:37:49,510
accessible

942
00:37:54,069 --> 00:37:50,400
or

943
00:37:56,069 --> 00:37:54,079
you would be able to uh to make some uh

944
00:37:58,310 --> 00:37:56,079
assessment as to whether or not an orbit

945
00:38:01,910 --> 00:37:58,320
lander flagship this decade

946
00:38:07,430 --> 00:38:01,920
was viable enough relatively early on

947
00:38:09,109 --> 00:38:07,440
um the um after the decadal survey was

948
00:38:12,630 --> 00:38:09,119
released

949
00:38:14,870 --> 00:38:12,640
the president's budget came out and one

950
00:38:16,069 --> 00:38:14,880
of the things that budget did was it

951
00:38:19,030 --> 00:38:16,079
moved up

952
00:38:21,670 --> 00:38:19,040
the new frontiers five competition by

953
00:38:24,310 --> 00:38:21,680
several years in general of course we

954
00:38:27,349 --> 00:38:24,320
are all so happy to hear that because

955
00:38:29,670 --> 00:38:27,359
new frontiers was falling behind in its

956
00:38:31,510 --> 00:38:29,680
cadence relative to that recommended uh

957
00:38:33,670 --> 00:38:31,520
by the decadal survey so we're very

958
00:38:37,109 --> 00:38:33,680
happy about that um

959
00:38:39,670 --> 00:38:37,119
but you know my my sense would be that

960
00:38:41,670 --> 00:38:39,680
it would be up to nasa to decide but the

961
00:38:44,829 --> 00:38:41,680
arguments in the report would probably

962
00:38:47,270 --> 00:38:44,839
favor doing one rather than

963
00:38:49,589 --> 00:38:47,280

both although that's not specifically

964
00:38:51,270 --> 00:38:49,599
addressed in the report the the the

965
00:38:54,069 --> 00:38:51,280
situation you described

966
00:38:56,230 --> 00:38:54,079
so just understand if

967
00:38:58,390 --> 00:38:56,240
if a team were considering proposing an

968
00:39:01,589 --> 00:38:58,400
enceladus mission for nf5

969
00:39:04,069 --> 00:39:01,599
that could put the flagship at risk

970
00:39:06,870 --> 00:39:04,079
later on is that

971
00:39:08,390 --> 00:39:06,880
just trying to understand

972
00:39:10,069 --> 00:39:08,400
i don't want to put words in your mouth

973
00:39:11,750 --> 00:39:10,079
yeah i don't i don't know that i agree

974
00:39:16,069 --> 00:39:11,760
with that i mean i think

975
00:39:18,390 --> 00:39:16,079
what we've seen in the history of just

976
00:39:20,950 --> 00:39:18,400
fundamentally compelling objects is that

977
00:39:23,670 --> 00:39:20,960
the more we the more we think about them

978
00:39:25,829 --> 00:39:23,680
the more we propose them the more we

979
00:39:28,470 --> 00:39:25,839
come up with ways to address them first

980
00:39:30,950 --> 00:39:28,480
of all we bring them more attention

981
00:39:33,750 --> 00:39:30,960
and we bring more weight to doing more

982
00:39:36,470 --> 00:39:33,760
there and sometimes we conceive of

983
00:39:38,230 --> 00:39:36,480
approaches that our committee in two

984
00:39:40,550 --> 00:39:38,240
years didn't think of you know that's

985
00:39:42,390 --> 00:39:40,560
always something uh something that you

986
00:39:44,470 --> 00:39:42,400
hope right that that

987
00:39:47,190 --> 00:39:44,480
there will be new great ideas out there

988
00:39:53,829 --> 00:39:47,200

inspired by uh proposers

989
00:39:58,630 --> 00:39:56,310
hi uh casey dreyer the planetary society

990
00:40:01,349 --> 00:39:58,640
uh one very quick process question

991
00:40:03,990 --> 00:40:01,359
really enjoyed the chapter on workforce

992
00:40:05,430 --> 00:40:04,000
and really important chapter um for me

993
00:40:06,870 --> 00:40:05,440
at least it was a little hard to take

994
00:40:08,390 --> 00:40:06,880
away the full narrative of that chapter

995
00:40:10,309 --> 00:40:08,400
because a lot of the

996
00:40:11,430 --> 00:40:10,319
charts were missing from the published

997
00:40:12,870 --> 00:40:11,440
report

998
00:40:14,150 --> 00:40:12,880
and i was wondering if there was any

999
00:40:15,589 --> 00:40:14,160
sense of a timeline of when we can

1000
00:40:17,510 --> 00:40:15,599
expect that

1001
00:40:20,950 --> 00:40:17,520
visual aspect of that chapter to be

1002
00:40:26,550 --> 00:40:23,670
so the um

1003
00:40:29,430 --> 00:40:26,560
the figures that are currently not

1004
00:40:31,829 --> 00:40:29,440
in the uh the released version are

1005
00:40:34,230 --> 00:40:31,839
withheld due to copyright issues

1006
00:40:36,470 --> 00:40:34,240
those are currently being um the

1007
00:40:39,589 --> 00:40:36,480
copyright permissions are totally are

1008
00:40:43,109 --> 00:40:40,630
sought

1009
00:40:45,589 --> 00:40:43,119
on a one by one basis and we're looking

1010
00:40:46,550 --> 00:40:45,599
at probably mid-summer

1011
00:40:49,270 --> 00:40:46,560
hopefully

1012
00:40:51,990 --> 00:40:49,280
mid to late summer okay to have the full

1013
00:40:54,790 --> 00:40:52,000

copy out with all the figures and and i

1014
00:40:57,109 --> 00:40:54,800
must say as a shout out to paul baron

1015
00:40:59,750 --> 00:40:57,119
and james um

1016
00:41:01,270 --> 00:40:59,760
keen tuttle the the figures many of

1017
00:41:03,990 --> 00:41:01,280
which they were involved with are

1018
00:41:06,790 --> 00:41:04,000
actually gorgeous in addition to the

1019
00:41:08,309 --> 00:41:06,800
graphs and plots the actual physic

1020
00:41:10,710 --> 00:41:08,319
the figures and the schematics are

1021
00:41:13,190 --> 00:41:10,720
really beautiful so i encourage everyone

1022
00:41:14,630 --> 00:41:13,200
to uh to look at that full report with

1023
00:41:15,990 --> 00:41:14,640
the figures in it once it comes out

1024
00:41:17,430 --> 00:41:16,000
thank you i'll look for the forwards of

1025
00:41:19,829 --> 00:41:17,440
that in the summer my other question was

1026
00:41:21,270 --> 00:41:19,839
about the science questions that was

1027
00:41:23,190 --> 00:41:21,280
listed and included in the report and

1028
00:41:25,190 --> 00:41:23,200
i'm curious about how the committee

1029
00:41:26,390 --> 00:41:25,200
approached that

1030
00:41:28,150 --> 00:41:26,400
from a

1031
00:41:29,750 --> 00:41:28,160
sense of are these

1032
00:41:32,069 --> 00:41:29,760
to me it seemed like very fundamental

1033
00:41:33,510 --> 00:41:32,079
types of questions facing the field

1034
00:41:34,390 --> 00:41:33,520
versus

1035
00:41:35,270 --> 00:41:34,400
questions

1036
00:41:36,630 --> 00:41:35,280
of

1037
00:41:37,910 --> 00:41:36,640
what you would achieve in 10 years

1038
00:41:39,030 --> 00:41:37,920

necessarily

1039
00:41:40,550 --> 00:41:39,040
um

1040
00:41:42,230 --> 00:41:40,560
is that an accurate way to reflect that

1041
00:41:44,230 --> 00:41:42,240
or do you see these as

1042
00:41:46,630 --> 00:41:44,240
questions that will be

1043
00:41:47,990 --> 00:41:46,640
driving fundamental

1044
00:41:49,670 --> 00:41:48,000
i guess for lack of better term

1045
00:41:50,870 --> 00:41:49,680
solutions or serious advancements and

1046
00:41:52,630 --> 00:41:50,880
then you'd have a different set of

1047
00:41:55,670 --> 00:41:52,640
questions pertinent to the next cable

1048
00:41:56,790 --> 00:41:55,680
survey that that's an excellent question

1049
00:42:00,790 --> 00:41:56,800
and

1050
00:42:03,990 --> 00:42:00,800
we approached defining the questions um

1051
00:42:06,630 --> 00:42:04,000
by trying to identify

1052
00:42:07,910 --> 00:42:06,640
broad cross-cutting questions

1053
00:42:10,230 --> 00:42:07,920
that should

1054
00:42:12,550 --> 00:42:10,240
perhaps with some minor modification due

1055
00:42:13,270 --> 00:42:12,560
to advances in the next decade

1056
00:42:16,069 --> 00:42:13,280
be

1057
00:42:17,349 --> 00:42:16,079
able to carry forward across decades in

1058
00:42:20,550 --> 00:42:17,359
other words we

1059
00:42:22,950 --> 00:42:20,560
we tried we started off

1060
00:42:25,349 --> 00:42:22,960
specifically by asking the steering

1061
00:42:28,069 --> 00:42:25,359
group members to each identify

1062
00:42:31,109 --> 00:42:28,079
a handful of what they saw were the

1063
00:42:33,510 --> 00:42:31,119

prime motivating questions that we are

1064
00:42:35,510 --> 00:42:33,520
trying to solve as our field nothing

1065
00:42:37,990 --> 00:42:35,520
narrow nothing related to a specific

1066
00:42:40,309 --> 00:42:38,000
object but the big cross-cutting

1067
00:42:41,910 --> 00:42:40,319
questions so then we gathered all of

1068
00:42:43,190 --> 00:42:41,920
those

1069
00:42:46,069 --> 00:42:43,200
and

1070
00:42:47,750 --> 00:42:46,079
even with that initial uh input it was

1071
00:42:51,190 --> 00:42:47,760
clear that these

1072
00:42:53,750 --> 00:42:51,200
three themes of origins processes life

1073
00:42:56,069 --> 00:42:53,760
and habitability came out very early on

1074
00:42:58,790 --> 00:42:56,079
with exoplanets as well

1075
00:43:01,030 --> 00:42:58,800
then we tried uh and then and then our

1076
00:43:02,870 --> 00:43:01,040
follow-up exercise was well how many

1077
00:43:03,990 --> 00:43:02,880
questions

1078
00:43:06,550 --> 00:43:04,000
and

1079
00:43:08,790 --> 00:43:06,560
we discussed things like we didn't want

1080
00:43:11,109 --> 00:43:08,800
them to be so broad

1081
00:43:13,190 --> 00:43:11,119
that you would end up with only a couple

1082
00:43:15,670 --> 00:43:13,200
overall and it would be hard to

1083
00:43:18,069 --> 00:43:15,680
distinguish between different activities

1084
00:43:19,670 --> 00:43:18,079
but we didn't want them to be so narrow

1085
00:43:22,790 --> 00:43:19,680
that they

1086
00:43:23,510 --> 00:43:22,800
corresponded to just a single object

1087
00:43:26,230 --> 00:43:23,520
so

1088
00:43:28,790 --> 00:43:26,240

you saw where the compromise ended up

1089
00:43:31,750 --> 00:43:28,800
and after we had put together those i

1090
00:43:33,670 --> 00:43:31,760
think i think i might even have this um

1091
00:43:35,190 --> 00:43:33,680
yeah after we had put together our

1092
00:43:37,670 --> 00:43:35,200
questions

1093
00:43:40,550 --> 00:43:37,680
and looked at their topical distribution

1094
00:43:42,150 --> 00:43:40,560
and so that's the pie chart on the left

1095
00:43:44,390 --> 00:43:42,160
including the

1096
00:43:46,950 --> 00:43:44,400
two really science-oriented chapters

1097
00:43:48,309 --> 00:43:46,960
human exploration and planetary defense

1098
00:43:49,750 --> 00:43:48,319
we did that all independent

1099
00:43:51,589 --> 00:43:49,760
independently we didn't look at the

1100
00:43:53,349 --> 00:43:51,599
prior decadal really we didn't look at

1101
00:43:54,950 --> 00:43:53,359
any other input that was purely the

1102
00:43:57,910 --> 00:43:54,960
steering group with feedback from the

1103
00:44:00,630 --> 00:43:57,920
committees i mean from the panels rather

1104
00:44:03,109 --> 00:44:00,640
after that we went back and looked at

1105
00:44:05,670 --> 00:44:03,119
the big picture priority questions that

1106
00:44:08,870 --> 00:44:05,680
the ag groups the assessment groups

1107
00:44:11,349 --> 00:44:08,880
league maps at mepeg opec sbag mexic vex

1108
00:44:13,670 --> 00:44:11,359
egg had generated in response to a

1109
00:44:16,390 --> 00:44:13,680
request from lori glaze to do so about a

1110
00:44:17,990 --> 00:44:16,400
year before the decadal started and then

1111
00:44:20,069 --> 00:44:18,000
we looked at their distribution of

1112
00:44:22,069 --> 00:44:20,079
topics and you can see it almost looks

1113
00:44:23,190 --> 00:44:22,079

like we started with theirs even though

1114
00:44:25,109 --> 00:44:23,200
we didn't

1115
00:44:27,750 --> 00:44:25,119
so at that point this gave us confidence

1116
00:44:30,069 --> 00:44:27,760
that we had the right distribution of

1117
00:44:33,190 --> 00:44:30,079
the questions by number across these

1118
00:44:39,430 --> 00:44:37,190
in terms of this specific sub questions

1119
00:44:41,589 --> 00:44:39,440
and strategic research we think those

1120
00:44:42,309 --> 00:44:41,599
will evolve from decade to decade and

1121
00:44:44,630 --> 00:44:42,319
the

1122
00:44:46,390 --> 00:44:44,640
strategic research activities were

1123
00:44:48,069 --> 00:44:46,400
defined

1124
00:44:50,870 --> 00:44:48,079
so as to

1125
00:44:53,030 --> 00:44:50,880
maximize progress in the next decade

1126
00:44:54,470 --> 00:44:53,040
with that as the guide thank you i mean

1127
00:44:55,670 --> 00:44:54,480
just to unite the two parts of my

1128
00:44:57,829 --> 00:44:55,680
questions it almost seems like these

1129
00:44:59,829 --> 00:44:57,839
questions pursuing them defines what the

1130
00:45:01,990 --> 00:44:59,839
workforce is as a to be a planetary

1131
00:45:03,670 --> 00:45:02,000
scientist defines the bounds of

1132
00:45:05,430 --> 00:45:03,680
the field right so if you're working to

1133
00:45:07,349 --> 00:45:05,440
answer one of these questions you're a

1134
00:45:09,589 --> 00:45:07,359
planetary scientist yes and it would be

1135
00:45:13,829 --> 00:45:09,599
part of that workforce discussion yep

1136
00:45:17,430 --> 00:45:15,190
i thank you very much for this

1137
00:45:19,829 --> 00:45:17,440
presentation so i have a question about

1138
00:45:23,510 --> 00:45:19,839

the research and analysis analysis

1139
00:45:25,750 --> 00:45:23,520
section of the reports so here um

1140
00:45:28,870 --> 00:45:25,760
the report mentions high risk high

1141
00:45:31,349 --> 00:45:28,880
impact proposals may be disadvantaged by

1142
00:45:33,190 --> 00:45:31,359
the proposal review process

1143
00:45:35,349 --> 00:45:33,200
and then there is a recommendation that

1144
00:45:37,349 --> 00:45:35,359
nasa should ensure an appropriate

1145
00:45:38,550 --> 00:45:37,359
balance between a high and low risk

1146
00:45:40,710 --> 00:45:38,560
proposal

1147
00:45:43,670 --> 00:45:40,720
and the risks being

1148
00:45:44,470 --> 00:45:43,680
in terms of exploration of novel ideas

1149
00:45:45,510 --> 00:45:44,480
and

1150
00:45:48,150 --> 00:45:45,520
techniques

1151
00:45:50,150 --> 00:45:48,160
so my question is simple

1152
00:45:54,150 --> 00:45:50,160
what's such an appropriate balance

1153
00:45:59,990 --> 00:45:57,430
so it's broad question sure sure so um

1154
00:46:02,470 --> 00:46:00,000
so one of the issues and

1155
00:46:04,150 --> 00:46:02,480
i think anyone that has

1156
00:46:06,630 --> 00:46:04,160
reviewed and

1157
00:46:09,349 --> 00:46:06,640
submitted rna proposals will probably be

1158
00:46:12,309 --> 00:46:09,359
familiar with this

1159
00:46:15,030 --> 00:46:12,319
effect and that is that

1160
00:46:18,710 --> 00:46:15,040
proposals that use established

1161
00:46:21,910 --> 00:46:18,720
techniques that pursue

1162
00:46:24,309 --> 00:46:21,920
well-accepted hypotheses tend to have an

1163
00:46:26,630 --> 00:46:24,319

advantage over ones that

1164
00:46:28,950 --> 00:46:26,640
are doing something that goes against

1165
00:46:31,030 --> 00:46:28,960
that standard grain either in thinking

1166
00:46:32,230 --> 00:46:31,040
or technique

1167
00:46:34,069 --> 00:46:32,240
it's just

1168
00:46:36,790 --> 00:46:34,079
kind of the way the the peer review

1169
00:46:38,470 --> 00:46:36,800
process can work sometimes and so the

1170
00:46:39,349 --> 00:46:38,480
the part of the rna chapter that you

1171
00:46:40,710 --> 00:46:39,359
mention

1172
00:46:42,550 --> 00:46:40,720
is

1173
00:46:44,069 --> 00:46:42,560
encouraging nasa because they've already

1174
00:46:47,109 --> 00:46:44,079
been doing so they already have been

1175
00:46:48,550 --> 00:46:47,119
looking into how to make sure that these

1176
00:46:50,790 --> 00:46:48,560
high risk

1177
00:46:52,630 --> 00:46:50,800
and risks can be several different

1178
00:46:54,630 --> 00:46:52,640
things in this context but high

1179
00:46:56,710 --> 00:46:54,640
potential reward activities to make sure

1180
00:46:58,790 --> 00:46:56,720
they're funded we encourage them to

1181
00:47:00,550 --> 00:46:58,800
continue to do so

1182
00:47:05,349 --> 00:47:00,560
and

1183
00:47:08,069 --> 00:47:05,359
traditional versus higher risk higher

1184
00:47:10,710 --> 00:47:08,079
impact activities we didn't actually

1185
00:47:11,750 --> 00:47:10,720
prescribe a particular balance of those

1186
00:47:13,750 --> 00:47:11,760
two

1187
00:47:15,270 --> 00:47:13,760
one thing that you'll see in the rna

1188
00:47:16,710 --> 00:47:15,280

chapter

1189
00:47:19,109 --> 00:47:16,720
is that

1190
00:47:20,710 --> 00:47:19,119
we establish what we think are the

1191
00:47:23,030 --> 00:47:20,720
important principles

1192
00:47:25,510 --> 00:47:23,040
but by design we've left

1193
00:47:28,710 --> 00:47:25,520
nasa with a lot of flexibility on

1194
00:47:30,549 --> 00:47:28,720
exactly how to implement

1195
00:47:32,390 --> 00:47:30,559
processes

1196
00:47:36,150 --> 00:47:32,400
to achieve those

1197
00:47:39,510 --> 00:47:36,160
and

1198
00:47:41,990 --> 00:47:39,520
the the data we were able to obtain on

1199
00:47:44,390 --> 00:47:42,000
the rna programs currently on what they

1200
00:47:46,309 --> 00:47:44,400
produce on the balance of

1201
00:47:48,390 --> 00:47:46,319
high risk versus low risk things that

1202
00:47:50,790 --> 00:47:48,400
are funded versus proposed

1203
00:47:53,829 --> 00:47:50,800
was not sufficient and complete enough

1204
00:47:56,870 --> 00:47:53,839
to do that kind of analysis either

1205
00:47:58,470 --> 00:47:56,880
okay thank you very much okay thank you

1206
00:48:00,870 --> 00:47:58,480
hi thank you for your service for the

1207
00:48:02,710 --> 00:48:00,880
decadal um in hindsight is there

1208
00:48:04,790 --> 00:48:02,720
anything in the statement work that you

1209
00:48:06,230 --> 00:48:04,800
thought was extraneous and anything that

1210
00:48:07,589 --> 00:48:06,240
you think should have been included in

1211
00:48:08,790 --> 00:48:07,599
the statement work once y'all were

1212
00:48:10,549 --> 00:48:08,800
working on it

1213
00:48:15,349 --> 00:48:10,559

like was it a good

1214
00:48:20,870 --> 00:48:17,109
or all great

1215
00:48:24,470 --> 00:48:22,870
this this will this will sound glib i

1216
00:48:26,549 --> 00:48:24,480
don't mean it too there were times when

1217
00:48:29,030 --> 00:48:26,559
one wish the statement of task was less

1218
00:48:31,349 --> 00:48:29,040
broad but that wasn't because it wasn't

1219
00:48:33,190 --> 00:48:31,359
appropriately broad it was just under

1220
00:48:36,390 --> 00:48:33,200
the weight of everything that had to be

1221
00:48:38,710 --> 00:48:36,400
done during a single decadal process

1222
00:48:40,870 --> 00:48:38,720
because the scope was quite large

1223
00:48:42,950 --> 00:48:40,880
um

1224
00:48:45,829 --> 00:48:42,960
but no i i don't think i i don't think i

1225
00:48:48,790 --> 00:48:45,839
can think of anything that um

1226
00:48:49,910 --> 00:48:48,800
was seen as being inappropriate

1227
00:48:53,990 --> 00:48:49,920
or

1228
00:48:56,710 --> 00:48:54,000
that we discussed that should be added

1229
00:48:59,670 --> 00:48:56,720
you know there are

1230
00:49:01,910 --> 00:48:59,680
there are topical transitions that occur

1231
00:49:03,990 --> 00:49:01,920
for example exoplanets is one of them

1232
00:49:06,309 --> 00:49:04,000
between the astrophysical decadal and

1233
00:49:08,309 --> 00:49:06,319
the planetary science decadal i thought

1234
00:49:10,470 --> 00:49:08,319
that transition in our statement of task

1235
00:49:13,349 --> 00:49:10,480
was handled very well we didn't cover

1236
00:49:16,309 --> 00:49:13,359
anything related to exoplanet detection

1237
00:49:17,990 --> 00:49:16,319
but in terms of comparative planetology

1238
00:49:20,390 --> 00:49:18,000

and what the study of our solar system

1239
00:49:23,270 --> 00:49:20,400
can tell us about exoplanets and

1240
00:49:25,589 --> 00:49:23,280
what studying exodus and exoplanets can

1241
00:49:27,589 --> 00:49:25,599
teach us about our solar system that was

1242
00:49:31,190 --> 00:49:27,599
within scope and i thought that fit in

1243
00:49:32,630 --> 00:49:31,200
very well with our science questions

1244
00:49:35,030 --> 00:49:32,640
so yeah i don't

1245
00:49:37,109 --> 00:49:35,040
don't know that i see any um

1246
00:49:39,109 --> 00:49:37,119
i think that the statement of task was

1247
00:49:42,710 --> 00:49:39,119
was very well posed actually great thank

1248
00:49:46,710 --> 00:49:45,349
uh yeah bethany tealing nasa goddard um

1249
00:49:48,309 --> 00:49:46,720
this is a great presentation i've seen

1250
00:49:50,790 --> 00:49:48,319
it a couple of times now so i really

1251
00:49:52,950 --> 00:49:50,800
appreciate each time i see it um i was

1252
00:49:55,109 --> 00:49:52,960
actually wondering because the uh two

1253
00:49:56,390 --> 00:49:55,119
recommended flagships are outer solar

1254
00:49:58,630 --> 00:49:56,400
system missions

1255
00:50:00,470 --> 00:49:58,640
um do you all give any recommendations

1256
00:50:03,190 --> 00:50:00,480
especially concrete recommendations on

1257
00:50:04,790 --> 00:50:03,200
how we can recruit and train

1258
00:50:06,470 --> 00:50:04,800
the generation of scientists and

1259
00:50:11,670 --> 00:50:06,480
engineers who are actually going to do

1260
00:50:15,190 --> 00:50:13,030
well of course

1261
00:50:16,950 --> 00:50:15,200
the um

1262
00:50:19,510 --> 00:50:16,960
identifying

1263
00:50:21,430 --> 00:50:19,520

recruiting retaining nurturing

1264
00:50:22,950 --> 00:50:21,440
the best people in our field overall

1265
00:50:25,270 --> 00:50:22,960
that's really the heart of the state of

1266
00:50:26,390 --> 00:50:25,280
profession chapter right

1267
00:50:27,829 --> 00:50:26,400
um

1268
00:50:30,549 --> 00:50:27,839
in addition

1269
00:50:33,190 --> 00:50:30,559
the um

1270
00:50:34,630 --> 00:50:33,200
the openly competed rna programs i mean

1271
00:50:36,790 --> 00:50:34,640
this was really the

1272
00:50:38,710 --> 00:50:36,800
uh the core of that whole chapter and

1273
00:50:42,150 --> 00:50:38,720
that recommendation to

1274
00:50:43,109 --> 00:50:42,160
substantially increase investment of rna

1275
00:50:47,030 --> 00:50:43,119
it's

1276
00:50:51,270 --> 00:50:47,040
get our

1277
00:50:53,349 --> 00:50:51,280
to

1278
00:50:55,109 --> 00:50:53,359
handle the new data coming in from

1279
00:50:57,190 --> 00:50:55,119
things that are planned but also the

1280
00:50:58,150 --> 00:50:57,200
workforce we need to develop the new

1281
00:51:00,870 --> 00:50:58,160
missions

1282
00:51:01,670 --> 00:51:00,880
okay it's very forward-looking as well

1283
00:51:02,950 --> 00:51:01,680
so

1284
00:51:10,549 --> 00:51:02,960
the

1285
00:51:12,710 --> 00:51:10,559
budget we're arguing it for to increase

1286
00:51:14,710 --> 00:51:12,720
from eight to ten percent

1287
00:51:16,069 --> 00:51:14,720
it's disproportionately where people

1288
00:51:17,829 --> 00:51:16,079

enter the field

1289
00:51:19,270 --> 00:51:17,839
and that's why we we place such an

1290
00:51:21,109 --> 00:51:19,280
emphasis on it

1291
00:51:23,030 --> 00:51:21,119
and i should also mention that while the

1292
00:51:25,430 --> 00:51:23,040
difference between eight and ten percent

1293
00:51:27,430 --> 00:51:25,440
may sound like a small difference it's

1294
00:51:29,030 --> 00:51:27,440
not a small difference to the rna

1295
00:51:30,870 --> 00:51:29,040
program itself

1296
00:51:33,190 --> 00:51:30,880
so that difference is about a forty

1297
00:51:34,870 --> 00:51:33,200
percent increase in the openly competed

1298
00:51:37,349 --> 00:51:34,880
programs

1299
00:51:40,069 --> 00:51:37,359
so so we see

1300
00:51:44,069 --> 00:51:40,079
uh we see both our state of profession

1301
00:51:47,349 --> 00:51:44,079
recommendations and that increase in rna

1302
00:51:49,190 --> 00:51:47,359
as well as of course the

1303
00:51:50,470 --> 00:51:49,200
the teams that will be supported by the

1304
00:51:51,829 --> 00:51:50,480
missions themselves

1305
00:51:53,670 --> 00:51:51,839
but i think what you're getting to is

1306
00:51:55,190 --> 00:51:53,680
really the workforce development issue

1307
00:51:57,510 --> 00:51:55,200
more than those

1308
00:52:00,710 --> 00:51:57,520
so it's really that

1309
00:52:02,710 --> 00:52:00,720
that increase in the rna that we see is

1310
00:52:04,870 --> 00:52:02,720
needed to you know instead of a

1311
00:52:07,349 --> 00:52:04,880
decreasing decline

1312
00:52:09,510 --> 00:52:07,359
you know get it on an even keel so it's

1313
00:52:12,790 --> 00:52:09,520

proportionate with the overall program

1314
00:52:17,190 --> 00:52:12,800
you're trying to um develop and sustain

1315
00:52:22,950 --> 00:52:19,829
yeah and actually and david smith just

1316
00:52:26,870 --> 00:52:22,960
reminded me of another recommendation uh

1317
00:52:30,230 --> 00:52:26,880
related uh to your point which is a

1318
00:52:32,829 --> 00:52:30,240
a small mission line known as simplex so

1319
00:52:35,430 --> 00:52:32,839
our statement of task um had us

1320
00:52:37,750 --> 00:52:35,440
prioritizing only the medium and large

1321
00:52:39,990 --> 00:52:37,760
class missions but we do talk about the

1322
00:52:42,470 --> 00:52:40,000
small mission program so simplex is

1323
00:52:43,910 --> 00:52:42,480
managed within the discovery program

1324
00:52:46,549 --> 00:52:43,920
and um

1325
00:52:49,270 --> 00:52:46,559
it's uh currently a

1326
00:52:51,990 --> 00:52:49,280
50 million dollar per call kind of

1327
00:52:52,950 --> 00:52:52,000
mission and it allows for a lot more

1328
00:52:55,349 --> 00:52:52,960
risk

1329
00:52:57,589 --> 00:52:55,359
for new technologies to be developed but

1330
00:52:59,750 --> 00:52:57,599
it also allows for new investigators to

1331
00:53:02,630 --> 00:52:59,760
be trained as well and so we talk about

1332
00:53:05,190 --> 00:53:02,640
its role in training that new generation

1333
00:53:06,790 --> 00:53:05,200
of pis and instrument scientists in the

1334
00:53:08,710 --> 00:53:06,800
report in addition we have a

1335
00:53:11,030 --> 00:53:08,720
recommendation that that cost cap be

1336
00:53:12,470 --> 00:53:11,040
increased to 80 million for future

1337
00:53:15,030 --> 00:53:12,480
simplex calls

1338
00:53:17,030 --> 00:53:15,040

so thanks david that's right

1339
00:53:19,430 --> 00:53:17,040
yeah hi thank you karen rodgers from

1340
00:53:22,309 --> 00:53:19,440
rensselaer polytechnic um my question is

1341
00:53:25,030 --> 00:53:22,319
getting back to scope um and i noticed

1342
00:53:27,349 --> 00:53:25,040
in the scope of the in the initial piece

1343
00:53:29,750 --> 00:53:27,359
of the document that origins of life

1344
00:53:32,150 --> 00:53:29,760
origins and emergence was specifically

1345
00:53:34,950 --> 00:53:32,160
stated as outside the scope and

1346
00:53:37,510 --> 00:53:34,960
well i understand that because 700 pages

1347
00:53:39,589 --> 00:53:37,520
seems like a lot to write

1348
00:53:41,910 --> 00:53:39,599
i guess i'm wondering

1349
00:53:44,870 --> 00:53:41,920
where you think that might sit given

1350
00:53:47,270 --> 00:53:44,880
that things like life inhabitability

1351
00:53:49,109 --> 00:53:47,280
learning from terrestrial life

1352
00:53:51,829 --> 00:53:49,119
early planetary conditions and looking

1353
00:53:53,829 --> 00:53:51,839
at biosignatures is really intimately

1354
00:53:55,750 --> 00:53:53,839
tied with origins of life research so

1355
00:53:58,150 --> 00:53:55,760
where should it sit it doesn't sit in

1356
00:54:02,470 --> 00:53:58,160
exoplanet decadal it doesn't sit in the

1357
00:54:05,430 --> 00:54:03,510
yeah

1358
00:54:06,790 --> 00:54:05,440
so i'm gonna

1359
00:54:09,190 --> 00:54:06,800
david's gonna be

1360
00:54:12,069 --> 00:54:09,200
perhaps the more expert responder here

1361
00:54:14,710 --> 00:54:12,079
so i think her question um pertains to

1362
00:54:17,510 --> 00:54:14,720
the origin of life topic

1363
00:54:20,470 --> 00:54:17,520

in particular and

1364
00:54:22,549 --> 00:54:20,480
the extent to which it's

1365
00:54:23,349 --> 00:54:22,559
outside our scope

1366
00:54:24,790 --> 00:54:23,359
but

1367
00:54:27,270 --> 00:54:24,800
um

1368
00:54:29,589 --> 00:54:27,280
naturally of course within it's central

1369
00:54:33,750 --> 00:54:29,599
to astrobiology and indeed is supported

1370
00:54:34,950 --> 00:54:33,760
by the astrobiology program and so where

1371
00:54:43,270 --> 00:54:34,960
where

1372
00:54:48,069 --> 00:54:45,670
well currently the origins of life don't

1373
00:54:49,670 --> 00:54:48,079
really fit into any of the decadal

1374
00:54:50,710 --> 00:54:49,680
surveys

1375
00:54:53,510 --> 00:54:50,720
but

1376
00:54:56,630 --> 00:54:53,520
that that's not necessarily a bad thing

1377
00:54:59,190 --> 00:54:56,640
it just means that somebody should lobby

1378
00:55:01,910 --> 00:54:59,200
the appropriate agencies to

1379
00:55:03,109 --> 00:55:01,920
start up such an activity

1380
00:55:05,430 --> 00:55:03,119
so

1381
00:55:07,510 --> 00:55:05,440
the closest thing i would think of is

1382
00:55:10,390 --> 00:55:07,520
the the report that robin mentioned the

1383
00:55:12,470 --> 00:55:10,400
2018 astrobiology strategy for the

1384
00:55:15,270 --> 00:55:12,480
search for life in the universe that's

1385
00:55:18,069 --> 00:55:15,280
probably the closest document that

1386
00:55:20,230 --> 00:55:18,079
discusses the origins of life

1387
00:55:21,270 --> 00:55:20,240
the only other academy report i can

1388
00:55:23,430 --> 00:55:21,280

think of

1389
00:55:25,589 --> 00:55:23,440
that does that is

1390
00:55:26,710 --> 00:55:25,599
was written before you were born

1391
00:55:28,630 --> 00:55:26,720
so

1392
00:55:31,030 --> 00:55:28,640
the search for life's origins which is

1393
00:55:33,510 --> 00:55:31,040
fantastic report but it was written in

1394
00:55:35,750 --> 00:55:33,520
the 1980s sure i was on that last one

1395
00:55:37,589 --> 00:55:35,760
with you so i i appreciate that

1396
00:55:40,309 --> 00:55:37,599
do you think this report on the

1397
00:55:43,349 --> 00:55:40,319
planetary would be strengthened

1398
00:55:45,829 --> 00:55:43,359
if origins were included if would it be

1399
00:55:47,589 --> 00:55:45,839
strengthened if we'd considered

1400
00:55:50,950 --> 00:55:47,599
if it were part of the state it would it

1401
00:55:53,750 --> 00:55:50,960
would have made a very complicated and

1402
00:55:55,349 --> 00:55:53,760
large process that we ran

1403
00:55:57,910 --> 00:55:55,359
even more

1404
00:56:01,109 --> 00:55:57,920
complicated and larger

1405
00:56:04,069 --> 00:56:01,119
uh i think the the survey as it stood

1406
00:56:05,829 --> 00:56:04,079
from a managerial perspective was about

1407
00:56:08,630 --> 00:56:05,839
as large as it could be

1408
00:56:09,589 --> 00:56:08,640
we had you know 97 people

1409
00:56:11,750 --> 00:56:09,599
uh

1410
00:56:13,990 --> 00:56:11,760
distributed amongst the panels in the

1411
00:56:15,670 --> 00:56:14,000
steering group and adding in

1412
00:56:17,430 --> 00:56:15,680
it might have been you know half a dozen

1413
00:56:19,510 --> 00:56:17,440

of extra people

1414
00:56:21,030 --> 00:56:19,520
um might have been the straw that broke

1415
00:56:23,190 --> 00:56:21,040
the camel's back

1416
00:56:25,270 --> 00:56:23,200
the other the other danger of including

1417
00:56:26,710 --> 00:56:25,280
things that are on the

1418
00:56:30,150 --> 00:56:26,720
since since a lot of the stuff we were

1419
00:56:33,030 --> 00:56:30,160
focusing on was related to missions

1420
00:56:35,270 --> 00:56:33,040
going places in the solar system looking

1421
00:56:37,510 --> 00:56:35,280
at objects beyond the souls and

1422
00:56:39,430 --> 00:56:37,520
telescopes when you bring in stuff

1423
00:56:41,270 --> 00:56:39,440
that's mainly focused on

1424
00:56:43,430 --> 00:56:41,280
lab studies

1425
00:56:44,710 --> 00:56:43,440
you get you get these

1426
00:56:46,390 --> 00:56:44,720
groups that

1427
00:56:47,510 --> 00:56:46,400
feel as though they're dangling on the

1428
00:56:49,910 --> 00:56:47,520
edge of the

1429
00:56:53,030 --> 00:56:49,920
organizational chart and

1430
00:56:56,069 --> 00:56:53,040
doesn't lead to a good good process

1431
00:56:56,870 --> 00:56:56,079
so i think for origins of life studies

1432
00:56:59,030 --> 00:56:56,880
uh

1433
00:57:01,030 --> 00:56:59,040
maybe the the need there is for

1434
00:57:02,950 --> 00:57:01,040
something separate

1435
00:57:05,990 --> 00:57:02,960
it may not be a decadal survey it might

1436
00:57:08,150 --> 00:57:06,000
be a science strategy that goes beyond

1437
00:57:09,670 --> 00:57:08,160
what's in the existing astrobiology

1438
00:57:11,109 --> 00:57:09,680

strategy

1439
00:57:13,030 --> 00:57:11,119
but um

1440
00:57:14,710 --> 00:57:13,040
certainly the the old our old committee

1441
00:57:16,710 --> 00:57:14,720
on the origins and evolution of life

1442
00:57:19,349 --> 00:57:16,720
tried to start a study

1443
00:57:22,069 --> 00:57:19,359
on on the theories of the origins of

1444
00:57:23,589 --> 00:57:22,079
life and we could not even write down

1445
00:57:25,349 --> 00:57:23,599
the statement of task

1446
00:57:29,030 --> 00:57:25,359
because there were so many diverse

1447
00:57:30,950 --> 00:57:29,040
groups pushing their ideas and i think

1448
00:57:34,069 --> 00:57:30,960
that field needs to

1449
00:57:35,589 --> 00:57:34,079
get itself a bit more organized than it

1450
00:57:37,750 --> 00:57:35,599
is currently

1451
00:57:40,230 --> 00:57:37,760
before they could even attempt

1452
00:57:42,150 --> 00:57:40,240
something as big as a decade or seven

1453
00:57:45,670 --> 00:57:42,160
and i think i probably said too much

1454
00:57:52,470 --> 00:57:49,910
thanks all right uh jen was up before me

1455
00:57:54,470 --> 00:57:52,480
jennifer scully jpl so um thank you for

1456
00:57:56,710 --> 00:57:54,480
all your work on the decatur survey my

1457
00:57:58,710 --> 00:57:56,720
question is about the recommendation to

1458
00:58:01,030 --> 00:57:58,720
raise the new frontiers and discovery

1459
00:58:02,710 --> 00:58:01,040
lifecycle cost caps so i'm wondering if

1460
00:58:05,670 --> 00:58:02,720
you can give us some more insights into

1461
00:58:06,870 --> 00:58:05,680
the committee's rationale for that and

1462
00:58:09,109 --> 00:58:06,880
any discussion that there might have

1463
00:58:10,710 --> 00:58:09,119

been about how to balance that within a

1464
00:58:12,390 --> 00:58:10,720
finite budget with respect to like

1465
00:58:14,230 --> 00:58:12,400
number of selections and other budget

1466
00:58:16,390 --> 00:58:14,240
priorities and things like that

1467
00:58:21,750 --> 00:58:16,400
yeah so um

1468
00:58:26,549 --> 00:58:23,670
on this list

1469
00:58:28,870 --> 00:58:26,559
when uh the number of discovery and new

1470
00:58:31,030 --> 00:58:28,880
frontier selections is listed here that

1471
00:58:33,430 --> 00:58:31,040
is that the new recommended cost caps

1472
00:58:34,630 --> 00:58:33,440
which are substantially larger

1473
00:58:37,910 --> 00:58:34,640
so

1474
00:58:39,510 --> 00:58:37,920
an overall uh an overall goal was to

1475
00:58:41,750 --> 00:58:39,520
bring the

1476
00:58:44,630 --> 00:58:41,760
cost structures and the cost caps for

1477
00:58:45,990 --> 00:58:44,640
those programs more in line with the

1478
00:58:48,549 --> 00:58:46,000
missions that have been recently

1479
00:58:50,789 --> 00:58:48,559
selected and that frankly we are all

1480
00:58:51,990 --> 00:58:50,799
thrilled about and want to see selected

1481
00:58:52,789 --> 00:58:52,000
in the future

1482
00:58:56,789 --> 00:58:52,799
so

1483
00:58:59,030 --> 00:58:56,799
we

1484
00:59:01,270 --> 00:58:59,040
recommended raising that cap

1485
00:59:02,630 --> 00:59:01,280
to 800 million

1486
00:59:05,349 --> 00:59:02,640
including

1487
00:59:06,710 --> 00:59:05,359
phases eighth ref

1488
00:59:10,309 --> 00:59:06,720

to

1489
00:59:14,950 --> 00:59:10,319
the

1490
00:59:17,270 --> 00:59:14,960
having a single cost cap predictable

1491
00:59:19,589 --> 00:59:17,280
cost that allows for high cadence

1492
00:59:21,670 --> 00:59:19,599
maximizing science per dollar at any

1493
00:59:23,030 --> 00:59:21,680
target you can go to

1494
00:59:25,190 --> 00:59:23,040
but

1495
00:59:27,030 --> 00:59:25,200
it's clear that the exciting discovery

1496
00:59:29,270 --> 00:59:27,040
missions

1497
00:59:31,030 --> 00:59:29,280
picked in the last several rounds

1498
00:59:33,190 --> 00:59:31,040
would not have been

1499
00:59:35,270 --> 00:59:33,200
well supported by anything like the 500

1500
00:59:37,750 --> 00:59:35,280
million dollar cost cap that vision

1501
00:59:40,870 --> 00:59:37,760
voyages had envisioned and that program

1502
00:59:43,349 --> 00:59:40,880
is evolving right we've we've uh we've

1503
00:59:46,470 --> 00:59:43,359
addressed a lot of

1504
00:59:49,270 --> 00:59:46,480
of science we have more ambitious goals

1505
00:59:51,829 --> 00:59:49,280
and desires for instrumentation

1506
00:59:54,870 --> 00:59:51,839
on the new frontier side of things

1507
00:59:58,309 --> 00:59:54,880
we recommended again a substantial

1508
01:00:02,150 --> 00:59:58,319
increase in the phase a through

1509
01:00:04,230 --> 01:00:02,160
f cost cap to 1.65 million

1510
01:00:07,109 --> 01:00:04,240
at new frontiers we also recommended

1511
01:00:10,150 --> 01:00:07,119
that there be an addition to that cost

1512
01:00:12,470 --> 01:00:10,160
cap um memory serves it's something like

1513
01:00:15,990 --> 01:00:12,480

30 million dollars per year of quiet

1514
01:00:18,230 --> 01:00:16,000
cruise phase so that at new frontiers

1515
01:00:20,870 --> 01:00:18,240
you maintain

1516
01:00:23,270 --> 01:00:20,880
a a constant level

1517
01:00:26,069 --> 01:00:23,280
for your instrumentation and your actual

1518
01:00:28,470 --> 01:00:26,079
mission once you get to your target

1519
01:00:30,309 --> 01:00:28,480
but that objects that require longer

1520
01:00:32,470 --> 01:00:30,319
crews in the solar system be that

1521
01:00:33,910 --> 01:00:32,480
because the objects are far away or

1522
01:00:35,750 --> 01:00:33,920
because you're going there and back

1523
01:00:37,270 --> 01:00:35,760
again because you're doing sample return

1524
01:00:40,390 --> 01:00:37,280
or you're going to the innermost solar

1525
01:00:43,589 --> 01:00:40,400
system that those be given in a level

1526
01:00:47,510 --> 01:00:43,599
playing field and again we were looking

1527
01:00:49,430 --> 01:00:47,520
to uh dragonfly as as an example of a

1528
01:00:51,510 --> 01:00:49,440
phenomenal mission just the type of

1529
01:00:53,510 --> 01:00:51,520
mission that we see

1530
01:00:55,589 --> 01:00:53,520
as being needed to address the priority

1531
01:00:57,510 --> 01:00:55,599
science questions with that said when

1532
01:00:59,190 --> 01:00:57,520
you raise the cost cap

1533
01:01:00,390 --> 01:00:59,200
you're going to have to account for it

1534
01:01:02,470 --> 01:01:00,400
in the budget

1535
01:01:04,630 --> 01:01:02,480
and we did that very specifically i

1536
01:01:06,549 --> 01:01:04,640
don't think i showed sand charts but you

1537
01:01:09,190 --> 01:01:06,559
can see here

1538
01:01:11,270 --> 01:01:09,200

part of our sand chart exercise for our

1539
01:01:13,910 --> 01:01:11,280
recommended program you see that new

1540
01:01:15,829 --> 01:01:13,920
frontiers and discovery lines

1541
01:01:17,510 --> 01:01:15,839
you see mars sample return that new

1542
01:01:19,589 --> 01:01:17,520
flagship number one that would be the

1543
01:01:21,030 --> 01:01:19,599
uranus new flagship number two would be

1544
01:01:24,789 --> 01:01:21,040
orbee lander

1545
01:01:28,230 --> 01:01:24,799
okay and so um so those cost caps were

1546
01:01:30,390 --> 01:01:28,240
included in this uh planning

1547
01:01:31,109 --> 01:01:30,400
okay thanks

1548
01:01:33,030 --> 01:01:31,119
yeah

1549
01:01:34,230 --> 01:01:33,040
ready uh yes thanks again for the work

1550
01:01:35,430 --> 01:01:34,240
oh i'm sorry i'm supposed to tell you

1551
01:01:37,510 --> 01:01:35,440
that this will be the last one brittany

1552
01:01:39,510 --> 01:01:37,520
thanks okay go ahead luckily there's no

1553
01:01:41,670 --> 01:01:39,520
one behind me um so i wanted to return

1554
01:01:43,589 --> 01:01:41,680
to this issue of the rna program so i

1555
01:01:45,750 --> 01:01:43,599
thought the um the recommended increase

1556
01:01:46,549 --> 01:01:45,760
was was obviously something that we need

1557
01:01:48,470 --> 01:01:46,559
to have

1558
01:01:50,710 --> 01:01:48,480
um but kind of returning to the theme

1559
01:01:52,870 --> 01:01:50,720
that karen was was striking

1560
01:01:54,549 --> 01:01:52,880
is that disproportionately astrobiology

1561
01:01:57,190 --> 01:01:54,559
has recently been affected by the way

1562
01:01:58,630 --> 01:01:57,200
that rna programs were cut in the last

1563
01:02:01,589 --> 01:01:58,640

decado survey

1564
01:02:03,270 --> 01:02:01,599
we said please never cut anything in rna

1565
01:02:04,470 --> 01:02:03,280
or make rna the last thing to cut in the

1566
01:02:06,710 --> 01:02:04,480
last three years we've seen a pretty

1567
01:02:08,230 --> 01:02:06,720
significant downturn in the rna funding

1568
01:02:09,990 --> 01:02:08,240
and most especially in the area of

1569
01:02:12,789 --> 01:02:10,000
astrobiology which has seen cuts between

1570
01:02:13,750 --> 01:02:12,799
20 and 30 percent despite the importance

1571
01:02:14,789 --> 01:02:13,760
of the questions that you have in the

1572
01:02:17,750 --> 01:02:14,799
decadal

1573
01:02:19,910 --> 01:02:17,760
so my worry is that by tying it to 10 of

1574
01:02:21,670 --> 01:02:19,920
the budget with the i would say

1575
01:02:22,870 --> 01:02:21,680
aggressive budget that we've proposed

1576
01:02:25,190 --> 01:02:22,880
here which would be amazing if we could

1577
01:02:27,510 --> 01:02:25,200
get it it seems like tying that number

1578
01:02:28,710 --> 01:02:27,520
then means that the rna program is also

1579
01:02:31,829 --> 01:02:28,720
going to go down

1580
01:02:33,349 --> 01:02:31,839
if the program scale also comes down

1581
01:02:35,910 --> 01:02:33,359
which means you have fewer flight

1582
01:02:39,510 --> 01:02:35,920
projects as well as has less rna money

1583
01:02:41,670 --> 01:02:39,520
so i wondered about the choice to tie it

1584
01:02:43,270 --> 01:02:41,680
uh to the scale of the program and not

1585
01:02:45,349 --> 01:02:43,280
to make stronger recommendations for it

1586
01:02:48,390 --> 01:02:45,359
never falling below that

1587
01:02:49,990 --> 01:02:48,400
rather than being always 10 percent

1588
01:02:52,150 --> 01:02:50,000

or something to that to that degree

1589
01:02:53,109 --> 01:02:52,160
because as those flight projects stop

1590
01:02:55,910 --> 01:02:53,119
happening

1591
01:02:58,069 --> 01:02:55,920
fewer scientists are supported and then

1592
01:03:00,150 --> 01:02:58,079
but the worry there is because it's even

1593
01:03:02,950 --> 01:03:00,160
in simplex which yes trains perhaps new

1594
01:03:05,190 --> 01:03:02,960
pis it this the size of the science team

1595
01:03:07,029 --> 01:03:05,200
is smaller which means it supports fewer

1596
01:03:08,470 --> 01:03:07,039
younger scientists in general yeah

1597
01:03:10,950 --> 01:03:08,480
absolutely

1598
01:03:14,630 --> 01:03:10,960
it's it's targeted mentoring essentially

1599
01:03:16,309 --> 01:03:14,640
uh of relatively small teams uh so

1600
01:03:18,069 --> 01:03:16,319
in all the issues you just brought up

1601
01:03:20,789 --> 01:03:18,079
were uh

1602
01:03:23,109 --> 01:03:20,799
are very important in that rna

1603
01:03:25,029 --> 01:03:23,119
and and that thinking fed into that rna

1604
01:03:26,309 --> 01:03:25,039
recommendation what i didn't show and i

1605
01:03:27,430 --> 01:03:26,319
guess i don't have it in my backup

1606
01:03:30,390 --> 01:03:27,440
slides

1607
01:03:31,430 --> 01:03:30,400
are our overall decision rules

1608
01:03:33,430 --> 01:03:31,440
for

1609
01:03:36,390 --> 01:03:33,440
what should be done

1610
01:03:38,230 --> 01:03:36,400
if the budget is constrained below that

1611
01:03:41,029 --> 01:03:38,240
of the level budget

1612
01:03:43,349 --> 01:03:41,039
and in that list which is essentially

1613
01:03:47,190 --> 01:03:43,359

from the first thing that should be cut

1614
01:03:47,990 --> 01:03:47,200
to the last you'll find rna is the last

1615
01:03:49,190 --> 01:03:48,000
so

1616
01:03:58,950 --> 01:03:49,200
um

1617
01:04:01,270 --> 01:03:58,960
is important and within the text that

1618
01:04:02,789 --> 01:04:01,280
precedes that recommendation

1619
01:04:04,789 --> 01:04:02,799
is language

1620
01:04:06,789 --> 01:04:04,799
that talks about

1621
01:04:08,069 --> 01:04:06,799
the importance of

1622
01:04:09,750 --> 01:04:08,079
stability

1623
01:04:12,710 --> 01:04:09,760
and that any

1624
01:04:16,069 --> 01:04:12,720
changes in the overall program

1625
01:04:19,430 --> 01:04:17,990
accommodated

1626
01:04:28,470 --> 01:04:19,440
as

1627
01:04:30,789 --> 01:04:28,480
changed i think it is true that if if

1628
01:04:33,349 --> 01:04:30,799
something catastrophic were to happen

1629
01:04:35,990 --> 01:04:33,359
and the program were to be you know

1630
01:04:38,069 --> 01:04:36,000
dramatically smaller than it is now a

1631
01:04:40,789 --> 01:04:38,079
smaller workforce would be needed by

1632
01:04:42,789 --> 01:04:40,799
nasa right that's not something any of

1633
01:04:45,029 --> 01:04:42,799
us even really want to think about i

1634
01:04:48,630 --> 01:04:45,039
hope that is not something that has any

1635
01:04:49,990 --> 01:04:48,640
likelihood of happening right um but uh

1636
01:04:53,109 --> 01:04:50,000
between the

1637
01:04:56,470 --> 01:04:53,119
uh the the percentage level investment

1638
01:04:59,510 --> 01:04:56,480

and and defining that as a minimum and

1639
01:05:02,789 --> 01:04:59,520
then having rna as the last thing to be

1640
01:05:05,109 --> 01:05:02,799
cut if things go below the level budget

1641
01:05:10,870 --> 01:05:05,119
those were our ways to address the