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Helicopter Acoustic Flight Test with Altitude Variation and Maneuvers

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Abstract

A cooperative flight test campaign between NASA and the U.S. Army was performed from September 2014 to February 2015. The purposes of the testing were to: investigate the effects of altitude variation on noise generation, investigate the effects of gross weight variation on noise generation, establish the statistical variability in acoustic flight testing of helicopters, and characterize the effects of transient maneuvers on radiated noise for a medium-lift utility helicopter. This test was performed at three test sites (0, 4000, and 7000 feet above mean sea level) with two aircraft (AS350 SD1 and EH-60L) tested at each site. This report provides an overview of the test, documents the data acquired and describes the formats of the stored data.

Contents

1 Introduction **13**

2 Technical Approach **15**

3 Description of Test Aircraft **15**
3.1 AS350 SD1 Test Aircraft 15
3.1.1 Aircraft Navigation and Tracking System 16
3.1.2 Airspeed Boom 16
3.1.3 Instrumentation Pallet 17
3.1.4 Aircraft Guidance 17
3.2 EH-60L Test Aircraft 17
3.2.1 EH-60L Instrumentation Description 18
3.2.2 Aircraft Guidance 18

4 Ground Instrumentation **18**
4.1 Microphone Instrumentation 18
4.2 Weather Instrumentation 19

5 Test Conditions **19**
5.1 Altitude Variation Conditions 19
5.2 Steady Flight Source Noise Conditions 21
5.3 Maneuver Conditions 22

6 Testing Phases **24**
6.1 Hollister 24
6.2 Sweetwater, 7000 Feet AMSL 24
6.3 Amedee, 4000 Feet AMSL 25
6.4 Salton Sea, 0 Feet AMSL 25

7 AS350 SD1 Results **26**

8 EH-60L Results **28**

9 Electronic Data Description **29**
9.1 Reference Files 29
9.2 Acoustic Pressure Time History Data 30
9.3 Microphone Location Files 30
9.4 Aircraft Data Files 30
9.5 Weather Data Files 31
9.5.1 Weather Balloon Sonde 31
9.5.2 Weather Sondes on Balloon Tether 31
9.5.3 Weather Stations 31
9.5.4 LIDAR 31
9.5.5 Wind Profile 32
9.5.6 Temperature Profile 32
9.5.7 Pressure Profile 32
9.6 Test Logs 32
9.7 Included MATLAB® Functions 32

10 Concluding Remarks **33**

List of Tables

1 Aircraft Specifications. 36
2 ANTS File Contents. 37
3 Data Logger File Contents. 38
4 ADS Signal List (ANALOG Group, Sample Rate: Continuous). 39
5 ADS Signal List (I01 Group, Sample Rate: 50 Hz). 41
6 ADS Signal List (I09 Group, Sample Rate: 200 Hz). 43
7 ADS Signal List (DGPS Group, Sample Rate: 10 Hz). 45
8 AS350 SD1 Altitude Variation V Condition Codes. 46
9 EH-60L Altitude Variation V Condition Codes. 46
10 Altitude Variation V Target Conditions. 47
11 AS350 SD1 Level Flight Condition Codes. 47
12 EH-60L Level Flight Condition Codes. 47
13 AS350 SD1 Descent Flight Condition Codes. 48
14 EH-60L Descent Flight Condition Codes. 49
15 EH-60L Steady Turn Condition Codes. 50
16 EH-60L Constant Speed Banks. 50
17 EH-60L Quick Stop. 50
18 EH-60L Accelerating and Decelerating Banks. 50
19 EH-60L Climbing Turns. 51
20 EH-60L Maneuver Condition Codes. 51
21 Altitude Variation Test Run Summary. 57
22 Sweetwater Positions. 58
23 Amedee Positions. 60

24 Salton Sea Positions. 62
25 Flight 273 Test Card, 9/30/2014, AS350 SD1, Sweetwater, 7000 Feet. 64
26 Flight 274 Test Card, 10/1/2014, AS350 SD1, Sweetwater, 7000 Feet. 68
27 Flight 275 Test Card, 10/2/2014, AS350 SD1, Sweetwater, 7000 Feet. 72
28 Flight 301 Test Card, 10/28/2014, AS350 SD1, Amedee, 4000 Feet. 75
29 Flight 302 Test Card, 10/29/2014, AS350 SD1, Amedee, 4000 Feet. 80
30 Flight 303 Test Card, 10/30/2014, AS350 SD1, Amedee, 4000 Feet. 86
31 Flight 044 Test Card, 2/13/15, AS350SD1, Salton Sea, 0 Feet. 91
32 Flight 045 Test Card, 2/14/15, AS350 SD1, Salton Sea, 0 Feet. 95
33 Flight 046 Test Card, 2/15/15, AS350 SD1, Salton Sea, 0 Feet. 99
34 Flight 047 Test Card, 2/16/15, AS350 SD1, Salton Sea, 0 Feet. 102
35 Flight 279 Test Card, 10/6/2014, EH-60L, Sweetwater, 7000 Feet. 104
36 Flight 280 Test Card, 10/7/2014, EH-60L, Sweetwater, 7000 Feet. 108
37 Flight 281 Test Card, 10/8/2014, EH-60L, Sweetwater, 7000 Feet. 110
38 Flight 310 Test Card, 11/6/2014, EH-60L, Amedee, 4000 Feet. 114
39 Flight 311 Test Card, 11/7/2014, EH-60L, Amedee, 4000 Feet. 119
40 Flight 312 Test Card, 11/8/2014, EH-60L, Amedee, 4000 Feet. 123
41 Flight 315 Test Card, 11/11/2014, EH-60L, Amedee, 4000 Feet. 128
42 Flight 316 Test Card, 11/12/2014, EH-60L, Amedee, 4000 Feet. 133
43 Flight 318 Test Card, 11/14/2014, EH-60L, Amedee, 4000 Feet. 139
44 Flight 038 Test Card, 2/7/15, EH-60L, Salton Sea, 0 Feet. 144
45 Flight 039 Test Card, 2/8/15, EH-60L, Salton Sea, 0 Feet. 148
46 Flight 040 Test Card, 2/9/15, EH-60L, Salton Sea, 0 Feet. 152
47 Reference List File Contents. 156
48 Pressure Time History File Contents. 157
49 AS350 SD1 Inflight Data File Contents. 158
50 EH-60L Inflight Data File Contents. 159

51 Balloon Sonde File Contents. 160
52 Weather Sonde File Contents. 161
53 Weather Station File Contents. 161
54 LIDAR File Contents. 162

List of Figures

1 Change in nondimensional parameter with altitude change. 163
2 The predicted variation in Blade-Vortex Interaction noise with change in altitude for a Bell 206B in 60 KIAS, -6 FPA descending flight [2], scale is in BVISPL. 164
3 AS350 SD1 Aircraft (Tail Number N61HL). 165
4 Instrumentation panel in AS350 SD1. 165
5 NASA ANTS unit. 166
6 Airspeed boom mounted on the AS350 SD1. 166
7 Boom mounts. 167
8 AS350 SD1 instrumentation pallet. 168
9 Instrumentation pallet installed in AS350 SD1. 169
10 EH-60L test aircraft (S/N 87-24657). 169
11 EH-60L Aircraft Data System computer and signal conditioner. 170
12 EH-60L dual LCD monitors. 170
13 EH-60L aircraft Data System diagram. 171
14 EH-60L aircraft control position sensor locations. 172
15 EH-60L guidance display. 173
16 Wireless Acoustic Measurement System. 174
17 Microphone inverted over groundboard. 175
18 Tethered weather balloon with weather sonde. 176
19 Temperature sensors being mounted on balloon tether. . . 177
20 ZephIR 300 portable LIDAR system. 177
21 Steady turn test technique diagram. 178
22 Overview of testing sites. 179
23 AS350 SD1 boom instrumented for rap test. 180
24 Sweetwater test site. 181
25 Amedee test site. 182
26 Salton Sea test site. 183
27 AS350 SD1 flight track repeatability for Sweetwater test phase. 184
28 AS350 SD1 flight track repeatability for Amedee test phase. 185
29 AS350 SD1 flight track repeatability for Salton Sea test phase. 186
30 RPM variation for all test points for the AS350 SD1. . . . 187
31 M_{H_e} vs M_{AT} for AS350 SD1. 188
32 μ vs M_{AT} for AS350 SD1. 189
33 C_W vs M_{AT} for AS350 SD1. 190

34 Averaged AS350 SD1 main rotor pulse, V1 and V2, 15° elevation angle. 191
35 Averaged AS350 SD1 main rotor pulse, V3 and V4, 15° elevation angle. 192
36 Averaged AS350 SD1 main rotor pulse, V5 and V6, 15° elevation angle. 193
37 Normalized averaged AS350 SD1 main rotor pulse, V1 and V2, 15° elevation angle. 194
38 Normalized averaged AS350 SD1 main rotor pulse, V3 and V4, 15° elevation angle. 195
39 Normalized averaged AS350 SD1 main rotor pulse, V5 and V6, 15° elevation angle. 196
40 Averaged AS350 SD1 main rotor pulse, lower C_W range, V1 and V2, 15° elevation angle. 197
41 Averaged AS350 SD1 main rotor pulse, mid C_W range, V1 and V2, 15° elevation angle. 198
42 Averaged AS350 SD1 main rotor pulse, upper C_W range, V1 and V2, 15° elevation angle. 199
43 Averaged AS350 SD1 main rotor pulse, lower C_W range, V3 and V4, 15° elevation angle. 200
44 Averaged AS350 SD1 main rotor pulse, mid C_W range, V3 and V4, 15° elevation angle. 201
45 Averaged AS350 SD1 main rotor pulse, upper C_W range, V3 and V4, 15° elevation angle. 202
46 Averaged AS350 SD1 main rotor pulse, lower C_W range, V5 and V6, 15° elevation angle. 203
47 Averaged AS350 SD1 main rotor pulse, mid C_W range, V5 and V6, 15° elevation angle. 204
48 Averaged AS350 SD1 main rotor pulse, upper C_W range, V5 and V6, 15° elevation angle. 205
49 AS350 SD1 aircraft parameters for Sweetwater, 7000 ft, V1 test condition. 206
50 AS350 SD1 aircraft parameters for Sweetwater, 7000 ft, V2 test condition. Gray box is target C_W range. Magenta line is target M_{H_e}. 207
51 AS350 SD1 aircraft parameters for Sweetwater, 7000 ft, V3 test condition. 208
52 AS350 SD1 aircraft parameters for Sweetwater, 7000 ft, V4 test condition. Gray box is target C_W range. Magenta line is target M_{H_e}. 209
53 AS350 SD1 aircraft parameters for Sweetwater, 7000 ft, V5 test condition. 210
54 AS350 SD1 aircraft parameters for Sweetwater, 7000 ft, V6 test condition. Gray box is target C_W range. Magenta line is target M_{H_e}. 211

55 AS350 SD1 aircraft parameters for Amedee, 4000 ft, V1 test condition. 212
56 AS350 SD1 aircraft parameters for Amedee, 4000 ft, V2 test condition. Gray box is target C_W range. Magenta line is target M_{H_e}. 213
57 AS350 SD1 aircraft parameters for Amedee, 4000 ft, V3 test condition. 214
58 AS350 SD1 aircraft parameters for Amedee, 4000 ft, V4 test condition. Gray box is target C_W range. Magenta line is target M_{H_e}. 215
59 AS350 SD1 aircraft parameters for Amedee, 4000 ft, V5 test condition. 216
60 AS350 SD1 aircraft parameters for Amedee, 4000 ft, V6 test condition. Gray box is target C_W range. Magenta line is target M_{H_e}. 217
61 AS350 SD1 aircraft parameters for Salton Sea, 0 ft, V1 test condition. 218
62 AS350 SD1 aircraft parameters for Salton Sea, 0 ft, V2 test condition. Gray box is target C_W range. Magenta line is target M_{H_e}. 219
63 AS350 SD1 aircraft parameters for Salton Sea, 0 ft, V3 test condition. 220
64 AS350 SD1 aircraft parameters for Salton Sea, 0 ft, V4 test condition. Gray box is target C_W range. Magenta line is target M_{H_e}. 221
65 AS350 SD1 aircraft parameters for Salton Sea, 0 ft, V5 test condition. 222
66 AS350 SD1 aircraft parameters for Salton Sea, 0 ft, V6 test condition. Gray box is target C_W range. Magenta line is target M_{H_e}. 223
67 True airspeed vs flight path angle for AS350 SD1 A and L conditions. 224
68 AS350 SD1 A and L condition aircraft parameters. 225
69 AS350 SD1 hemispheres for run number 275225, normalized, 73.6 KTAS, -1.1° FPA. 226
70 AS350 SD1 hemispheres for run number 275226, normalized, 84.6 KTAS, -0.9° FPA. 227
71 AS350 SD1 hemispheres for run number 275227, normalized, 107.2 KTAS, -0.8° FPA. 228
72 AS350 SD1 hemispheres for run number 275228, normalized, 117.8 KTAS, -0.6° FPA. 229
73 AS350 SD1 hemispheres for run number 275229, normalized, 128.8 KTAS, -1.0° FPA. 230
74 AS350 SD1 hemispheres for run number 275257, normalized, 74.0 KTAS, -1.1° FPA. 231

75 AS350 SD1 hemispheres for run number 275258, normalized, 84.5 KTAS, -0.8° FPA. 232
76 AS350 SD1 hemispheres for run number 275259, normalized, 107.8 KTAS, -0.5° FPA. 233
77 AS350 SD1 hemispheres for run number 275260, normalized, 119.9 KTAS, 0.1° FPA. 234
78 AS350 SD1 hemispheres for run number 275261, normalized, 126.7 KTAS, -0.3° FPA. 235
79 AS350 SD1 hemispheres for run number 301148, normalized, 69.3 KTAS, -1.0° FPA. 236
80 AS350 SD1 hemispheres for run number 301149, normalized, 80.0 KTAS, -0.5° FPA. 237
81 AS350 SD1 hemispheres for run number 301150, normalized, 101.9 KTAS, -0.3° FPA. 238
82 AS350 SD1 hemispheres for run number 301151, normalized, 111.9 KTAS, -0.3° FPA. 239
83 AS350 SD1 hemispheres for run number 301152, normalized, 122.8 KTAS, 0.3° FPA. 240
84 AS350 SD1 hemispheres for run number 45521, normalized, 89.4 KTAS, -4.7° FPA. 241
85 AS350 SD1 hemispheres for run number 45522, normalized, 108.3 KTAS, -4.3° FPA. 242
86 AS350 SD1 hemispheres for run number 45523, normalized, 86.4 KTAS, -3.1° FPA. 243
87 AS350 SD1 hemispheres for run number 45524, normalized, 86.7 KTAS, -3.0° FPA. 244
88 AS350 SD1 hemispheres for run number 45525, normalized, 89.4 KTAS, -8.6° FPA. 245
89 AS350 SD1 hemispheres for run number 45526, normalized, 90.7 KTAS, -9.2° FPA. 246
90 AS350 SD1 hemispheres for run number 45527, normalized, 106.2 KTAS, -2.4° FPA. 247
91 AS350 SD1 hemispheres for run number 45528, normalized, 107.1 KTAS, -2.3° FPA. 248
92 AS350 SD1 hemispheres for run number 45529, normalized, 66.8 KTAS, -2.6° FPA. 249
93 AS350 SD1 hemispheres for run number 45530, normalized, 66.7 KTAS, -2.8° FPA. 250
94 AS350 SD1 hemispheres for run number 45531, normalized, 67.0 KTAS, -5.1° FPA. 251
95 AS350 SD1 hemispheres for run number 45533, normalized, 67.8 KTAS, -8.5° FPA. 252
96 AS350 SD1 hemispheres for run number 45534, normalized, 67.7 KTAS, -7.9° FPA. 253
97 AS350 SD1 hemispheres for run number 45566, normalized, 47.8 KTAS, -0.2° FPA. 254

98 AS350 SD1 hemispheres for run number 45567, normalized, 48.5 KTAS, -0.4° FPA. 255
99 AS350 SD1 hemispheres for run number 45568, normalized, 47.8 KTAS, -0.2° FPA. 256
100 AS350 SD1 hemispheres for run number 45569, normalized, 66.7 KTAS, -0.3° FPA. 257
101 AS350 SD1 hemispheres for run number 45570, normalized, 67.1 KTAS, -0.2° FPA. 258
102 AS350 SD1 hemispheres for run number 45571, normalized, 66.8 KTAS, -0.4° FPA. 259
103 EH-60L flight track repeatability for Sweetwater test phase. 260
104 EH-60L flight track repeatability for Amedee test phase. . 261
105 EH-60L flight track repeatability for Salton Sea test phase. 262
106 M_{H_e} vs M_{AT} for EH-60L. 263
107 μ vs M_{AT} for EH-60L. 264
108 C_W vs M_{AT} for EH-60L. 265
109 EH-60L aircraft parameters for Sweetwater, 7000 ft, V7 test condition. 266
110 EH-60L aircraft parameters for Sweetwater, 7000 ft, V8 test condition. Gray box is target C_W range. Magenta lines are target μ and M_{AT}. 267
111 EH-60L aircraft parameters for Sweetwater, 7000 ft, V9 test condition. 268
112 EH-60L aircraft parameters for Sweetwater, 7000 ft, V10 test condition. Gray box is target C_W range. Magenta lines are target μ and M_{AT}. 269
113 EH-60L aircraft parameters for Sweetwater, 7000 ft, V11 test condition. 270
114 EH-60L aircraft parameters for Sweetwater, 7000 ft, V12 test condition. Gray box is target C_W range. Magenta lines are target μ and M_{AT}. 271
115 EH-60L aircraft parameters for Amedee, 4000 ft, V7 test condition. 272
116 EH-60L aircraft parameters for Amedee, 4000 ft, V8 test condition. Gray box is target C_W range. Magenta lines are target μ and M_{AT}. 273
117 EH-60L aircraft parameters for Amedee, 4000 ft, V9 test condition. 274
118 EH-60L aircraft parameters for Amedee, 4000 ft, V10 test condition. Gray box is target C_W range. Magenta lines are target μ and M_{AT}. 275
119 EH-60L aircraft parameters for Amedee, 4000 ft, V11 test condition. 276
120 EH-60L aircraft parameters for Amedee, 4000 ft, V12 test condition. Gray box is target C_W range. Magenta lines are target μ and M_{AT}. 277

121 EH-60L aircraft parameters for Salton Sea, 0 ft, V7 test condition. 278
122 EH-60L aircraft parameters for Salton Sea, 0 ft, V8 test condition. Gray box is target C_W range. Magenta lines are target μ and M_{AT}. 279
123 EH-60L aircraft parameters for Salton Sea, 0 ft, V9 test condition. 280
124 EH-60L aircraft parameters for Salton Sea, 0 ft, V10 test condition. Gray box is target C_W range. Magenta lines are target μ and M_{AT}. 281
125 EH-60L aircraft parameters for Salton Sea, 0 ft, V11 test condition. 282
126 EH-60L aircraft parameters for Salton Sea, 0 ft, V12 test condition. Gray box is target C_W range. Magenta lines are target μ and M_{AT}. 283
127 True airspeed vs flight path angle for EH-60L A and L conditions. 284
128 EH-60L L0 to L3 condition aircraft parameters. 285
129 EH-60L L4 condition aircraft parameters. 286
130 EH-60L L5 to L9 condition aircraft parameters. 287
131 EH-60L L10 to L16 condition aircraft parameters. 288
132 EH-60L A1 to A9 condition aircraft parameters. 289
133 EH-60L A10 to A17 condition aircraft parameters. 290
134 EH-60L A18 to A25 condition aircraft parameters. 291
135 EH-60L A26 to A32 condition aircraft parameters. 292
136 EH-60L A33 to A37 condition aircraft parameters. 293
137 EH-60L M1 test condition, 110 knots, level 20° right bank. 294
138 EH-60L M2 test condition, 95 knots, level 20° right bank. 295
139 EH-60L M3 test condition, 65 knots, level 20° right bank. 296
140 EH-60L M4 test condition, 110 knots, level 30° right bank. 297
141 EH-60L M5 test condition, 95 knots, level 30° right bank. 298
142 EH-60L M6 test condition, 65 knots, level 30° right bank. 299
143 EH-60L M7 test condition, 110 knots, level 20° left bank. 300
144 EH-60L M8 test condition, 95 knots, level 20° left bank. . 301
145 EH-60L M9 test condition, 65 knots, level 20° left bank. . 302
146 EH-60L M10 test condition, 110 knots, level 30° left bank. 303
147 EH-60L M11 test condition, 95 knots, level 30° left bank. 304
148 EH-60L M12 test condition, 65 knots, level 30° left bank. 305
149 EH-60L M13 test condition, 95 knots, moderate quick stop. 306
150 EH-60L M14 test condition, 95 knots, aggressive quick stop. 307
151 EH-60L M15 test condition, 95 knots, pull up, push over. 308
152 EH-60L M16 test condition, 110 knots, pull up, push over. 309
153 EH-60L M17 test condition, 40-140 knots, max level acceleration. 310
154 EH-60L M18 test condition, 80 knots, level approach, establish moderate acceleration then 30° right bank. 311

155 EH-60L M19 test condition, 80 knots, level approach, establish maximum acceleration then 30° right bank. 312
156 EH-60L M20 test condition, 80 knots, level approach, establish moderate acceleration then 30° left bank. 313
157 EH-60L M21 test condition, 80 knots, level approach, establish maximum acceleration then 30° left bank. 314
158 EH-60L M22 test condition, 120 knots, level approach, establish moderate deceleration then 30° right bank. . . . 315
159 EH-60L M23 test condition, 120 knots, level approach, establish maximum deceleration then 30° right bank. . . . 316
160 EH-60L M24 test condition, 120 knots, level approach, establish moderate deceleration then 30° left bank. 317
161 EH-60L M25 test condition, 120 knots, level approach, establish maximum deceleration then 30° left bank. 318
162 EH-60L M26 test condition, 80 knots, level approach, establish 3° climb then right bank. 319
163 EH-60L M27 test condition, 80 knots, level approach, establish 3° climb then left bank. 320
164 EH-60L M28 test condition, 95 knots, level approach, establish 3° climb then right bank. 321
165 EH-60L M29 test condition, 95 knots, level approach, establish 3° climb then left bank. 322
166 EH-60L M30 test condition, 110 knots, level approach, establish 3° climb then right bank. 323
167 EH-60L M31 test condition, 110 knots, level approach, establish 3° climb then left bank. 324
168 EH-60L M32 test condition, 80 knots, level approach, establish 6° climb then right bank. 325
169 EH-60L M33 test condition, 80 knots, level approach, establish 6° climb then left bank. 326
170 EH-60L M34 test condition, 95 knots, level approach, establish 6° climb then right bank. 327
171 EH-60L M35 test condition, 95 knots, level approach, establish 6° climb then left bank. 328
172 EH-60L M36 test condition, 110 knots, level approach, establish 6° climb then right bank. 329
173 EH-60L M37 test condition, 110 knots, level approach, establish 6° climb then left bank. 330
174 EH-60L M38 test condition, 80 knots, level approach, initiate 6° climb and right bank. 331
175 EH-60L M39 test condition, 80 knots, level approach, initiate 6° climb and left bank. 332
176 EH-60L M40 test condition, 80 knots, level approach, initiate deceleration and right bank. 333
177 EH-60L M41 test condition, 80 knots, level approach, initiate deceleration and left bank. 334

178 EH-60L M42 test condition, 80 knots, level approach, pull-up to 6° and hold. 335
179 EH-60L M43 test condition, 80 knots, level approach, 30° right bank. 336
180 EH-60L M44 test condition, 80 knots, level approach, 30° left bank. 337
181 EH-60L S1 test condition, right 15° steady turn, 65 knots, run 318578. 338
182 EH-60L S1 test condition, right 15° steady turn, 65 knots, run 318579. 339
183 EH-60L S1 test condition, right 15° steady turn, 65 knots, run 318580. 340
184 EH-60L S2 test condition, right 30° steady turn, 65 knots, run 318581. 341
185 EH-60L S2 test condition, right 30° steady turn, 65 knots, run 318582. 342
186 EH-60L S2 test condition, right 30° steady turn, 65 knots, run 318583. 343
187 EH-60L S3 test condition, left 15° steady turn, 65 knots, run 318584. 344
188 EH-60L S3 test condition, left 15° steady turn, 65 knots, run 318585. 345
189 EH-60L S3 test condition, left 15° steady turn, 65 knots, run 318586. 346
190 EH-60L S3 test condition, left 15° steady turn, 65 knots, run 318587. 347
191 EH-60L S3 test condition, left 15° steady turn, 65 knots, run 318588. 348
192 EH-60L S4 test condition, left 30° steady turn, 65 knots, run 318589. 349
193 EH-60L S4 test condition, left 30° steady turn, 65 knots, run 318590. 350
194 EH-60L S4 test condition, left 30° steady turn, 65 knots, run 318591. 351
195 EH-60L S5 test condition, right 15° steady turn, 95 knots, run 318592. 352
196 EH-60L S5 test condition, right 15° steady turn, 95 knots, run 318593. 353
197 EH-60L S5 test condition, right 15° steady turn, 95 knots, run 318594. 354
198 EH-60L S6 test condition, right 30° steady turn, 95 knots, run 318595. 355
199 EH-60L S6 test condition, right 30° steady turn, 95 knots, run 318596. 356
200 EH-60L S6 test condition, right 30° steady turn, 95 knots, run 318597. 357

201 EH-60L S7 test condition, left 15° steady turn, 95 knots, run 318598. 358
202 EH-60L S7 test condition, left 15° steady turn, 95 knots, run 318599. 359
203 EH-60L S7 test condition, left 15° steady turn, 95 knots, run 318600. 360
204 EH-60L S8 test condition, left 30° steady turn, 95 knots, run 318601. 361
205 EH-60L S8 test condition, left 30° steady turn, 95 knots, run 318602. 362
206 EH-60L S8 test condition, left 30° steady turn, 95 knots, run 318603. 363
207 Electronic data file structure. 364

Acronyms and Nomenclature

a_0	Ambient speed of sound at sea level
a_1	Ambient speed of sound at altitude
ADS	Airframe Data System
$AFDD$	Aeroflightdynamics Directorate
AGL	Above Ground Level
AMB	Ambient
$AMSL$	Above Mean Sea Level
$ANTS$	Aircraft Navigation and Tracking System
$ASCII$	American Standard Code for Information Interchange
BVI	Blade Vortex Interaction
$BVISPL$	Blade Vortex Interaction Sound Pressure Level
C_T	Coefficient of thrust
C_W	Coefficient of weight
dB	decibels ref 20 micro pascals
ex	True East coordinate in the LEN coordinate system
ey	True North coordinate in the LEN coordinate system
FPA	Flight Path Angle
$FRAME$	Fundamental Rotorcraft Acoustic Modeling from Experiments
GPS	Global Positioning System
GW	Gross Weight
HSI	Human-Systems Interface
INS	Inertial Navigation System
INU	Inertial Navigation Unit
ISA	International Standard Atmosphere
$KIAS$	Knots Indicated Airspeed
$KTAS$	Knots True Airspeed
$LaRC$	Langley Research Center
LEN	Local East North
M_{AT}	Advancing tip Mach number

M_H	Hover tip Mach number
M_{H_e}	Effective hover tip Mach number
$NetCDF$	Network Common Data Form
N_R	Rotor speed as percent of nominal
$OASPL$	Overall Sound Pressure Level
p'	Acoustic pressure
p'_n	Normalized acoustic pressure
P_0	Ambient static pressure at sea level
P_1	Ambient static pressure at altitude
R	Main rotor radius
SPL	Sound Pressure Level
$TOGW$	Takeoff Gross Weight
UTC	Coordinated Universal Time
V_H	Maximum horizontal airspeed
V_{TAS}	True airspeed
$WAMS$	Wireless Acoustic Measurement System
x	Coordinate system with +x along the nominal direction of flight
y	Coordinate system with +y rotated 90°s counterclockwise from +x
z	Vertical coordinate in both LEN and local coordinate system
μ	Rotor advance ratio
ρ_0	Ambient air density at sea level
ρ_1	Ambient air density at altitude
χ	Wake skew ratio
Ω	Main rotor rotational speed
Ω_0	Nominal main rotor rotational speed

1 Introduction

Historically, the noise data used in rotorcraft mission planning and community impact analysis have been measured at one altitude and then subsequently applied at all altitudes for acoustic predictions. However, the variation of ambient air density and temperature with the altitude above sea level has well-known effects on the aerodynamic performance of the aircraft. Consequently, the aerodynamically-generated noise of helicopter rotors will also change in response to changes in the ambient conditions. These effects need to be quantified and considered when applying acoustic data acquired at one ambient condition to other ambient conditions.

Limited research has been previously conducted on the effects of changes in ambient conditions on helicopter noise generation. Boxwell et al. [1], identified the governing nondimensional parameters of rotor harmonic noise from theory and developed acoustic scaling laws to relate noise measurements from model-scale rotors in wind tunnels to in-flight measurements of full-scale vehicles. These scaling laws suggest that if the nondimensional governing parameters defining the rotor operating condition are held constant, the resulting noise radiation will scale with the ambient pressure. Unfortunately, for a constant airspeed, flight path angle, and gross weight (parameters used by helicopter operators and in acoustic mission planning tools), the nondimensional parameters governing rotor noise generation will vary as the ambient conditions change. Figure 1 demonstrates how these nondimensional governing parameters change as ambient conditions change with the standard atmosphere at various altitudes. The top figure shows the effects of altitude on speed of sound (a_0), density (ρ_0), and static pressure (P_0). The middle and lower figures show the corresponding changes in the advance ratio (μ), wake skew ratio (χ), coefficient of thrust (C_T), and advancing tip Mach number (M_{AT}) for a 4000 pound aircraft flying at 80 knots indicated airspeed. Greenwood and Schmitz estimated the effects of changing ambient conditions on helicopter harmonic noise radiation for the dimensionally-defined flight conditions used by operators and existing mission-planning tools [2]. These effects were estimated using a semi-empirical model of the Bell 206 helicopter built using the nondimensional Fundamental Rotorcraft Acoustic Modeling from Experiments (FRAME) [3]. Significant changes in the amplitude and directivity of noise radiation were predicted as the ambient density and temperature varied. For example, Figure 2 shows the predicted variation in Blade-Vortex Interaction (BVI) noise with changes in altitude for a standard atmosphere. Not only do the noise radiation characteristics vary, they do so nonlinearly with variations in altitude. Different variations were predicted for other rotor noise sources, such as thickness and steady-loading. These results imply that changes in the acoustic state of the helicopter with changing ambient conditions must be accounted for in order to make accurate noise predictions and that it is unlikely that simple empirical noise models can be developed that capture these effects. While the physics-based FRAME method may be capable of generalizing measured noise data collected under one set of ambient conditions to another, data did not exist to validate this application of the method.

More recently, the NASA/Army flight vehicle acoustics team at the NASA Langley Research Center (LaRC) collected acoustic data for helicopters of the same model across a limited range of density-altitudes and temperatures. The data show substantial variation in the magnitude and directivity of radiated noise as ambient conditions changed. Because the variation in altitude was incidental to other test objectives, the vehicle operating conditions and configuration were not selected specifically to provide scientific data on the changes in noise radiation with changes in ambient conditions. However, these data underscored the importance of quantifying and understanding these effects in future tests.

2 Technical Approach

The NASA LaRC and the U.S. Army Aeroflightdynamics Directorate (AFDD) conducted a joint flight test to acquire validation data for the modeling of altitude variations and maneuvers in FRAME. Testing occurred at three altitudes (approximately sea level, 4000, and 7000 feet AMSL) on two aircraft at each site to give a wide variation in atmospheric conditions. Measurements were acquired for flight conditions defined in terms of dimensional and nondimensional quantities at each test site. In addition, two takeoff gross weights were flown at each altitude for each aircraft: one baseline weight that was held constant at each test site, and a calibrated gross weight specific to each test site that allowed the same nondimensional flight conditions to be maintained across all three test site altitudes. This gross weight variation allows the effects of gross weight on noise to be examined. At least nine repeated runs of each test condition were flown at each altitude to provide statistically relevant data on the variability of aircraft noise for the same nominal flight condition. Lastly, transient maneuvers were flown for the medium lift aircraft at one altitude to investigate the effects of maneuvers on noise.

3 Description of Test Aircraft

The test was flown with a Eurocopter AS350 SD1 and a Sikorsky EH-60L aircraft, which are described below.

3.1 AS350 SD1 Test Aircraft

One of the aircraft tested was an AS350 SD1, Tail Number N61HL. The aircraft was originally manufactured by Eurocopter as an AS350 BA, and later modified by Soloy Aviation to the AS350 SD1 configuration, powered by a single Honeywell LTS101-600A-3A engine. This aircraft is a commercially available light aircraft and is shown in Figure 3; aircraft characteristics are shown in Table 1. The aircraft was placed in the Experimental category for each of the flight phases. Instrumentation to record airspeed, position, attitude, angles of attack and sideslip, and outside air temperature was installed on the aircraft. The fuel expenditure of the aircraft was obtained from fuel readings that were relayed from the pilot on a regular basis. The fuel gauge used for these readings is shown in Figure 4. The gross weight of the aircraft was calculated throughout each flight by subtracting the expended fuel weight from the known Take Off Gross Weight (TOGW). This methodology yielded an estimated weight accuracy of ±50 pounds.

3.1.1 Aircraft Navigation and Tracking System

An Aircraft Navigation and Tracking System (ANTS, Figure 5) unit developed by NASA LaRC, and previously flown by the Army Aviation Applied Technology Directorate, (AATD) on their AH-64D during the 2013 Chicken Little test at Eglin AFB, was installed on the AS350 SD1. ANTS incorporates a VectorNav VN-200 Inertial Navigation System (INS) chip into a self-contained device that receives the GPS signal, processes the GPS data in conjunction with built-in sensors, calculates a solution, and logs the aircraft attitude, heading, position, and rates to an SD memory card. ANTS data were sampled and recorded at 50 Hz throughout the test campaign. Power was provided by four AA NiMH batteries (1.2 V, 2300 mAh each). The GPS signal was provided by a GPS antenna located behind the wind screen of the aircraft. Table 2 lists the measured parameters (and their accuracies) written to the internal SD card for this test.

3.1.2 Airspeed Boom

An instrumentation boom that measures and records aircraft angle of attack, angle of sideslip, airspeed, and temperature was developed and manufactured by the NASA Ames Research Center for this test. The boom, shown installed on the aircraft in Figure 6, was mounted on the aircraft using modified Airfilm camera mounts as shown in Figure 7. The boom was mounted on the pilot (starboard) side of the aircraft to give the pilot good visibility of the boom. The design characteristics and stress analysis of the boom are contained in a separate document entitled "AS350 Air Data boom Installation Stress Analysis". The boom total weight is 50 pounds and is 212 inches long. A frequency analysis of the boom predicted the modes to be: Modes 1, 2 at 5.65; Modes 3, 4 at 32.89; Modes 5, 6 at 82.07 Hz. A rap test measured natural frequencies at 5 and 29.3 Hz. The rotor natural frequencies are 6.4, 12.8, 19.2, and 25.6 Hz, which are sufficiently far from the boom frequencies. An FEM analysis of the boom and boom mounting brackets yielded a Factor of Safety of 3.85 for a 3g maneuver. The longitudinal center of gravity (CG) limits for the AS350 SD1 helicopter are 124.8 to 137.4 inches forward of the reference datum. Analysis places the CG range during the testing, with the boom installed, at 127.3 to 133.3 inches. An airspeed calibration of the boom was performed before any data flights were flown. The data from the boom were recorded on a data logger. The airspeed boom was removed between test sites and reinstalled after arrival at the test site. The boom was carefully installed in the same position and orientation each time without disturbing the pressure lines, thus maintaining the calibration.

3.1.3 Instrumentation Pallet

An instrumentation pallet was created for this test that contained an ANTS unit, data logger and battery. These systems were mounted on a 12x18 inch plate, shown in Figure 8. The plate was secured to the helicopter floor behind the front passenger seat using two Camloc 2600 series quarter-turn fasteners. Figure 9 shows the instrumentation pallet installed in the aircraft. This installation conformed to FAR Part 27.561 crash loads requirements, and the analysis is contained in a separate document entitled "AS350 SD1InstMountingLoads". The minimum Factor of Safety for this installation was 3.6. The GPS time code and additional parameters were passed to the data logger through a serial port connection and recorded with the boom data. The format for the output file from the data logger is described in Table 3. Note that the data from the airspeed boom contained in these raw files are uncalibrated. Calibrated outputs are provided in the processed files and described in a later section.

3.1.4 Aircraft Guidance

The AS350 SD1 did not have a guidance system installed. Altitude above the ground was determined by the aircraft landing at the pad located at each test site at the beginning of the day and setting the altimeter to a reference altitude determined for that site. For level flight conditions, the aircraft then flew the target altimeter reading that gave the appropriate height above the reference position. Direction was determined by flying over preset markers on the ground. Descents were flown by flying to a predetermined ground marker at a predetermined altitude. Once reaching the ground marker at the entry altitude, the aircraft achieved a steady descent by flying to a target on the ground. This method yielded descent angles within $\pm 0.5°$ of the desired descent angle.

3.2 EH-60L Test Aircraft

The second test aircraft, shown in Figure 10, was an EH-60L Advanced QuickFix helicopter, Army Serial Number 87-24657, operated by AFDD. The characteristics of the aircraft are listed in Table 1. The aircraft is powered by two General Electric T700-GE-701C turboshaft engines. All of the QuickFix mission equipment has been removed with the exception of the inertial measurement unit and associated navigation control panel and Control Display Unit (CDU). Additionally, AFDD removed all external antennas from the aircraft making the airframe similar to a standard UH-60L with the exception of some minor fuselage vents used for the environmental control system on the right side of the aircraft over the fuel cells and in the transition section where avionics are installed. The EH-60L was flown with engine intake filters installed at Salton Sea.

3.2.1 EH-60L Instrumentation Description

Instrumentation racks and a PC-based Airframe Data System (ADS) were installed in the cabin (Figure 11), research sensors were installed throughout the control system, and antennas for the research GPS unit and telemetry were mounted externally on the aircraft. The pilot station instruments have been modified with two LCD displays (Figure 12) that can receive video data from various cameras mounted to the aircraft or display symbology generated by the onboard graphics computer. The ADS uses LabView software running on the Windows 2000 operating system. The ADS data are divided into groups corresponding to the analog signals, an RS232-formatted data block from the load instrumentation (data from the load instrumentation is telemetered to the ADS through a pair of Freewave modems), 1553-formatted data messages from the ship's INU/GPS (I01, I09, and IH1) and a RS232-formatted data block from an Ashtech GPS (a DGPS base station may be used to uplink corrections to the Ashtech on the aircraft but was not used for this test). Each of these data groups has its own entry port into the PC and is post-processed at 100 Hz regardless of the measurement rate (continuous, INU at 50 and 200 Hz, GPS at 10 Hz). A diagram of the ADS data flow is shown in Figure 13. The location of the control position sensors is shown in Figure 14. The signals recorded for this test on the ADS are listed in Tables 4 through 7. Also mounted in the EH-60L was an ANTS unit that independently recorded GPS and INU information. Both the ADS and ANTS used the same GPS antenna positioned on the vertical fin.

3.2.2 Aircraft Guidance

Guidance for the EH-60L was performed utilizing a flight symbology tailored for acoustic testing developed by AFDD Human-Systems Interface (HSI) Technical Area researchers. A flight path oriented, 3-D perspective symbology, with integrated speed and altitude error cues, moving-map display with path predictor trace, aural cueing, and a multitude of preconfigured flight trajectories allowed the EH-60L test pilot to fly myriad test points in an efficient, precise, and repeatable manner. A set of GPS coordinates of predetermined waypoints was loaded into the system before the day's testing began. However, the system was flexible enough that modifications of these predetermined trajectories could be accomplished during the test flight and greatly enhanced the quality of the data acquired. Sample symbology is shown in Figure 15.

4 Ground Instrumentation

4.1 Microphone Instrumentation

The acoustic data were acquired using the NASA Mobile Acoustic Facility. This facility consists of two trailers; one is used to control the flight test and the other to maintain the 36 Wireless Acoustic Measurement System (WAMS) available to record the acoustic signals. Each WAMS consists of a ground board, microphone, Global Positioning System (GPS) receiver, and radio antenna (Figure 16). Coordinated Universal Time (UTC) obtained from the GPS was used to synchronize all microphone, aircraft, and weather information. The WAMS setup consisted of a 1/2-inch Falcon (B&K 4189) microphone inverted with the diaphragm 1/4 inch over a 15-inch round ground board, shown in Figure 17. Notice the microphone is offset from the center of the ground board to minimize the edge effects. This inverted microphone and ground board configuration is based on the SAE Aerospace Recommended Practice ARP4055 [4]. The acoustic signals were acquired at 25,000 Hz at 16-bit resolution. Up to 27 of these systems were deployed at one time for this test.

The primary microphone layout used for all sites for this series of tests was a linear array of 21 microphones. Additional microphones were used as required and depended on the testing site for number and placement.

4.2 Weather Instrumentation

An extensive set of weather measurements was made throughout the test. A tethered weather balloon system (Figure 18) was located near the control trailer sufficiently far away from the flight path to not interfere with the aircraft. The balloon altitude was fixed such that the weather sonde was at the primary aircraft altitude above ground level (AGL). The weather sonde data (wind speed, wind direction, temperature, pressure, humidity, and density) were radioed to the control trailer and displayed in real time. The temperature profile was measured by placing three to four temperature sensors (Figure 19) on the balloon tether. These sensors recorded temperature, pressure, and humidity as function of UTC for post processing. A ZephIR 300 portable IEC 60825-1 Class 1 eye-safe LIDAR system was also deployed during testing and is shown in Figure 20. The LIDAR system measured wind speed and wind direction at 13 locations up to 900 feet AGL. This system was placed under the aircraft flight path from 3000 to 1000 feet before the reference microphone depending on access for each test location. Additionally, between 2 and 5 ground weather stations that measured wind speed, wind direction, pressure, temperature and humidity were mounted on 4 tripods and placed among the microphone array.

5 Test Conditions

5.1 Altitude Variation Conditions

In order to measure the effects of changes in ambient conditions due to altitude variations (i.e., air density and temperature) on rotor noise generation, the flight conditions of the helicopters were defined in two different ways: dimensionally and nondimensionally.

The first set of flight conditions was defined in terms of a constant indicated airspeed and flight path angle, the dimensional parameters typically used by pilots and mission planners and used to define conditions in previous acoustic flight tests. For each aircraft, three of these conditions were defined— moderate speed level flight, high speed level flight, and moderate speed descending flight condition. By holding these dimensionally-defined flight conditions constant at all three test sites, the effects of changing altitude on noise radiation were directly measured for the manner in which helicopters are typically flown.

The second set of flight conditions was defined nondimensionally using the parameters that are believed to govern the acoustic state of the helicopter's rotor. These governing parameters include the advance ratio, μ, and the advancing tip Mach number, M_{AT}. These parameters are defined as:

$$\mu = \frac{V_{TAS}}{\Omega R} \tag{1}$$

$$M_{AT} = (1 + \mu)\frac{\Omega R}{a_0} \tag{2}$$

Based on real-time measurements of the ambient density and temperature at the flight altitude, the dimensional flight condition of the helicopter was carefully adjusted to match these parameters for each run. For the EH-60L, the indicated airspeed and rotor speed, $N_R = \Omega/\Omega_0$, were varied to match the specified values for advance ratio and advancing tip Mach number. However, precise rotor speed control was not available on the AS350 SD1; consequently, matching both the advance ratio and advancing tip Mach number with variations in air temperature was not possible. Instead, the nondimensional flight conditions for the AS350 SD1 were defined in terms of Gopalan and Schmitz's effective hover tip Mach number M_{H_e} [5]. The effective hover tip Mach number is the hover tip Mach number, M_H, adjusted for Doppler amplification due to forward flight and was identified by Gopalan and Schmitz as the key scaling parameter for rotor thickness noise. The effective hover tip Mach number is expressed in terms of the rotor advance ratio, μ, and advancing tip Mach number, M_{AT}, using the expression:

$$M_{H_e} = \frac{M_{AT}}{1 + \mu\,(1 - M_{AT})} \tag{3}$$

The effective hover tip Mach number will match for all flight conditions where both the advancing tip Mach number, M_{AT}, and advance ratio, μ, are matched, such as those flown by the EH-60L. For the AS350 SD1, in which N_R is held constant, the indicated airspeed required to match M_{H_e} will be between the airspeeds required to match μ and M_{AT}. Throughout the flight test campaign, each aircraft cycled through the six dimensionally and nondimensionally defined flight conditions over the duration of flights, so that test points were sampled evenly across the daily variations in ambient conditions.

In addition to matching the dimensional or nondimensional parameters that define a flight condition, the takeoff gross weight of the vehicle (TOGW) was varied at the start of each data collection flight. For each vehicle, flights were conducted at a baseline TOGW that did not vary with test site altitude. Additional flights were conducted using a TOGW selected for each site to match the main rotor weight coefficient (C_W) as air density varied. Thus, noise data were collected across a wide range of C_W for each vehicle due to fuel burn throughout the flight and TOGW variations.

The condition numbers are specified in Table 8 for the AS350 SD1 and Table 9 for the EH-60L. The target nondimensional parameters are summarized in Table 10.

5.2 Steady Flight Source Noise Conditions

Steady state source noise characterization data were also acquired for both aircraft. The conditions flown for source noise acquisition were level flight from 40 to 140 KIAS; 3 to 12 degree descents at 50 to 110 KIAS; and full power climbs at 80 KIAS depending on the capabilities of the aircraft being tested. The level flight conditions were performed at 150 foot AGL. Tables 11 and 12 show the level flight conditions and condition codes for the AS350 SD1 and the EH-60L.

Descent conditions were initiated at an altitude such as to intersect the ground midway between the primary and secondary arrays. The aircraft initiated the descent to achieve a constant descent rate and on the flight path 3000 feet before the primary array. Minimal control inputs were performed after a steady condition was reached with the pilot maintaining the flight path and descent rate. The aircraft terminated the descent in sufficient time to remain above 50 feet AGL. The EH-60L also performed climbs by approaching the array at 50 foot AGL and initiating the climb 2000 feet before the primary array. Tables 13 and 14 show the descent flight condition codes for the AS350 SD1 and the EH-60L.

Steady level flight with constant bank-angle turns were flown over the linear ground array with the EH-60L. These turns were not considered maneuver conditions since the goal was to achieve a steady and not a dynamic flight condition. The methodology is shown conceptually in Figure 21. The helicopter approached parallel to the array and offset from the array line; the offset distance equaled the radius of the turn for that airspeed and bank angle. A stable turn was achieved by the time a heading 45 degrees offset from the flight line was reached, with the goal of crossing the reference microphone. The pilot maintained the designated angle of bank (15 or 30 degrees), maintaining a constant airspeed at 200 foot AGL throughout the steady portion of the turn. The steady portion of the turn was maintained for at least 90 degrees of heading change. The aircraft then exited the turn parallel to the microphone array. Both left and right hand turns were flown. The steady turn condition codes are specified in Table 15.

5.3 Maneuver Conditions

The rapidly changing aerodynamics of a maneuvering helicopter can significantly change the acoustic emissions of that aircraft. These changes in acoustics emissions with changing aerodynamics were extensively investigated in 2011 on a Bell Model 430 helicopter and are reported in Reference [6]. However, the 2011 effort focused on single control inputs. To further validate the FRAME maneuver prediction capabilities on more complex maneuvers and on a heavier, more modern aircraft, several days of data acquisition were dedicated to acquiring maneuver acoustics of the EH-60L. In general, the pilot approached the linear array at 100 feet AGL and executed the maneuver 2000 feet before the primary array. An overview of the maneuver conditions are presented in Tables 16 through 19. The maneuver test conditions are described in general below and listed in Table 20.

Maneuver points M1 to M12 are right and left turns conducted at 100 feet AGL. M1 to M3 and M7 to M9 are 20° bank turns while M4 to M6 and M10 to M12 are 30° bank turns. For all turns, the aircraft approached along the normal flight track and initiated the turns at a point 2000 feet before the primary microphone array. The pilot called data-on about 1000 feet before initiating the turn (3000 feet before the primary array). The turn was held until the vehicle heading changed by 90° or the aircraft had exited the array, at which point the pilot called data-off and terminated the run.

Maneuver points M13 and M14 are quick stops where the aircraft is stopped while not exceeding normal terrain flight maneuver operating conditions. For both these runs, the deceleration from steady flight at 95 knots was initiated at a point 2000 feet before the primary microphone array. Data-on was called about 1000 feet prior to initiating the deceleration (3000 feet before the primary array) and data-off was called when the aircraft achieved a hover condition.

M15 and M16 are pull-up/push-over maneuvers performed at 95 and 110 knots, respectively. The pull-up was initiated at 2000 feet before the primary microphone array with data-on called 1000 feet before initiating the maneuver (3000 feet before the primary array). Data-off was called after the push-over when the aircraft established a level flight condition and crossed the secondary array.

M17 is a maximum level flight acceleration maneuver. The aircraft approached along the normal flight track at 100 feet AGL, 40 knots. A maximum acceleration, level flight condition was initiated 2000 feet before the primary microphone array and held until the vehicle accelerated to about 140 knots. Data-on was called at least 5 seconds prior to initiating the acceleration and data-off called when the vehicle reached 140 knots.

M18 to M21 are left and right accelerating turns. The aircraft approached along the normal flight track at 100 feet AGL and 80 knots. A level acceleration was initiated at 2000 feet before the primary array and then the pilot began the turn. The pilot called data-on about 1000 feet before initiating the maneuver (3000 feet before the primary array). The turn was held until the vehicle heading had changed by 90° or the aircraft had exited the array, at which point the pilot called data-off and terminated the run.

M22 to M25 are left and right decelerating turns. The aircraft approached along the normal flight track at 100 feet AGL and 120 knots. A level deceleration was initiated at 2000 feet before the primary array and the pilot began the turn. The pilot called data-on about 1000 feet before initiating the maneuver (3000 feet before the primary array). The turn was held until the vehicle heading had changed by 90° or the aircraft had exited the array, at which point the pilot called data-off and terminated the run.

M26 to M37 are left and right climbing turns at constant speed. The aircraft approached along the normal flight track at 100 feet AGL and 80, 95, or 110 knots. A constant speed climb at the specified FPA was initiated at 2000 feet before the primary array and then the pilot began the turn. The pilot called data-on about 1000 feet before initiating the maneuver. The turn was held until the vehicle heading had changed by 90° or the aircraft had exited the array, at which point the pilot called data-off and terminated the run.

M38 to M39 are left and right climbing banks. The aircraft approached along the normal flight track at 100 feet AGL and 80 knots. The pilot called data-on about 1000 feet before initiating the maneuver (3000 feet before the primary array). At 2000 feet before the primary array, the pilot simultaneously initiated a climb and bank at a constant airspeed. The turn was then held until the vehicle heading had changed by 90° or the aircraft had exited the array, at which point the pilot called data-off and terminated the run.

M40 to M41 were left and right decelerating turns. The aircraft approached along the normal flight track at 100 feet AGL and 80 knots. A level constant speed turn was then initiated at 2000 feet before the primary array. At the time of the initiation of the turn the aircraft began decelerating at 0.15g to 50 knots. The pilot maintained level flight at 100 foot AGL. The pilot called data-on about 1000 feet before initiating the turn (3000 feet before the primary array). The turn was held until the vehicle heading had changed by 90° or the aircraft had exited the array, at which point the pilot called data-off and terminated the run.

M42 is similar to M38 but without bank. The aircraft approached along the normal flight track at 100 feet AGL and 80 knots. At 2000 feet before the primary array the pilot simultaneously initiated a climb to +6° FPA, maintaining 80 knots throughout 1 second transition, steady climb-out at 80 knots, 6° climb angle over 10 seconds. Data-off was called after the aircraft crossed the primary array.

M43 and M44 are level flight right and left turns at a 30° bank angle. The pilot called data-on about 1000 feet before initiating the maneuver at 2000 feet before the primary array. The turn was held until the vehicle heading had changed by 90° or the aircraft had exited the array, at which point the pilot called data-off and terminated the run.

M45 and M46 are level flights at 110 KIAS along the primary array at 150 feet AGL flown from west to east at 100.5% and 96.5% N_R.

6 Testing Phases

The test campaign was performed in three phases corresponding to three test sites. The three test sites were chosen to have the widest possible density altitude variation and for their proximity to the aircraft bases to minimize the ferry time of both aircraft to the test sites. NASA Ames Research Center was the base for the EH-60L. Riverside, CA and Hollister, CA were the two bases for the AS350 SD1. Historical weather data were examined for each of the three primary test sites and the dates of testing at each site were selected to achieve similar ambient temperatures across all three sites. These locations are shown in Figure 22 and will be described in the following sections. Table 21 provides a summary of the NASA and Army flight and run numbers, nominal takeoff weights and data type taken for both aircraft at all three testing sites.

6.1 Hollister

The week before the first test phase, the boom installation, instrumentation checkout, and calibration flight of the AS350 SD1 were performed at Hollister Municipal Airport, CA where Aris Helicopters maintains a support facility. The boom was rap tested after installation and before the first flight to verify that the boom resonant frequencies were within acceptable and safe levels. Figure 23 shows the boom instrumented for the rap test.

Two airspeed calibration flights were performed after the aircraft instrumentation was installed. These consisted of flying upwind and downwind at airspeeds of 60, 80, 90, 100, and 110 knots. Descents were also performed at 80 knots at descent rates of -400, -900, and -1300 feet per minute. These data were used to develop calibration curves that were applied to the boom data.

6.2 Sweetwater, 7000 Feet AMSL

Phase I was performed at the Sweetwater USMC auxiliary airfield located near Bridgeport, CA. The land is owned by the National Park Service but used by the USMC under an agreement between the Marine Corp

Mountain Warfare Training Center and the park service for C130 aircraft and troop training. This phase of testing focused on altitude variation test conditions, but a limited amount of source noise data for the EH-60L was also acquired. Figure 24 shows the microphone positions, flight path over the microphones, weather balloon, control trailers, and LIDAR position at the Sweetwater test site. The microphone locations are listed in Table 22. This table contains the latitude, longitude, ellipsoid height in feet from the GPS survey as well as the coordinates in Local East North (LEN) and local coordinate systems. The LEN coordinate system (ey, ex, z) is a Cartesian coordinate system whose origin was at the microphone 11 position with +ex is True East, +ey is True North, and +z is up. The local coordinate system (x, y, z) is a Cartesian system, which also has the origin at the microphone 11 position, but with the +x along the nominal flight direction for that site. This microphone 11 position is referred to as the reference location. The LEN coordinates were rotated by 100.59° in the counter-clockwise direction (349.41° True aircraft heading) to generate the local coordinate system. Additionally, Table 22 lists the GPS locations and Cartesian coordinates of the non-microphone key locations.

6.3 Amedee, 4000 Feet AMSL

Phase II of the test was performed at Amedee Army Airfield located on the Sierra Army Depot, CA. This phase of testing included altitude variation, source, and maneuver conditions. Figure 25 shows the microphone positions, flight path over the microphones, weather balloon, control, and LIDAR position. The microphone locations are listed in Table 23. The coordinate systems (defined previously) are centered at the reference location (microphone 11) but the local coordinate system is rotated by 83° in the counter-clockwise direction (7° True aircraft heading) from the LEN.

6.4 Salton Sea, 0 Feet AMSL

Phase III was performed at the U.S. Navy training facility Camp Billy Machen located at Salton Sea near Niland, CA. Yuma Proving Grounds provided testing liaison service. Figure 26 shows the microphone positions, flight path over the microphones, weather balloon, control, and LIDAR position. The microphone locations are listed in Table 24. The coordinate systems (defined previously) are centered at the reference location (microphone 11) but the local coordinate system is rotated by 171.15° in the counter-clockwise direction (278.85° True aircraft heading) from the LEN.

7 AS350 SD1 Results

The AS350 SD1 flew a total of 65.8 hours, with 27.5 of those being over the test sites with 633 data runs being acquired. This section will present sample results from all phases of the testing of the AS350 SD1 aircraft. Flight cards for the AS350 SD1 are listed in Tables 25 through 27 for Sweetwater (7000 feet AMSL), Tables 28 through 30 for Amedee (4000 feet AMSL), and Tables 31 through 34 for Salton Sea (0 feet AMSL). Flight track repeatability between Altitude Variation (V) series runs at each test site is shown in Figures 27 through 29. The flight track repeatability was good with a range of ±50 feet being held in the y direction and ±100 feet in the z direction for the descent track in almost all cases. Of even more importance is that the descent angle was repeatable during the test points.

The rotor RPM could not be accurately adjusted so was set at 100% N_R (nominally 394 RPM). However, the RPM governor is fairly coarse with the flight manual indicating an RPM range of ±4 RPM. The RPM during the test runs was calculated during post-processing by de-Dopolerizing the acoustic signal recorded at the reference microphone, performing an FFT of that signal, finding the frequency of the fundamental and then calculating the RPM from that frequency. Figure 30 shows the averaged RPM calculated using this method as a function of KIAS. The RPM range was primarily within the range specified in the aircraft manual with some exceptions. This RPM variation results in a 0.5% standard deviation for μ, M_{H_e}, and M_{AT}. The nondimensional parameters reported are based on the nominal 394 RPM.

As mentioned in Section 5.1, the airspeed was set to achieve a specified M_{H_e} for cases aiming to match nondimensional parameters. Figure 31 shows the relationship between M_{H_e} and M_{AT} for the data taken. Since M_{H_e} is not a commonly used parameter, M_{AT} will be used in this paper for comparisons. The advance ratio versus advancing tip Mach number for the V1 through V6 test conditions at all three sites is shown in Figure 32. Figure 33 shows the weight coefficient versus advancing tip Mach number for the same test points. These figures demonstrate the desired effect of achieving a tighter band on desired aircraft state by flying an indicated airspeed based on atmospheric conditions. The target effective hover tip Mach number, advance ratio and weight coefficient are also shown on the figures as a solid line.

Figures 34, 35, and 36 show an averaged main rotor pulse for all the V1 through V6 runs at all three sites for all vehicle weights. The measured acoustic signals have been corrected for installation effects, time-based de-Dopolerized, and normalized to 100 ft radius. The 60 rotor pulses centered at 15° elevation at an azimuth of 180° were ensemble averaged to produce a single representative main rotor pulse. All the averaged pulses are plotted in black with the average of the averages being plotted in yellow. The minimum of the yellow line is displayed and the number of runs contained on the graph is also shown. A distinct variation in the amplitude and shapes of the pulses can be seen for the dimensional conditions V1, V3, and V5 while the nondimensional conditions V2, V4, and V6 are relatively similar. As suggested by Boxwell et al. [1], the acoustic pressures can be normalized to standard sea level conditions using the expression:

$$\begin{aligned} p'_n &= \frac{\gamma \rho_0 a_0^2}{\gamma \rho_1 a_1^2} p' \\ &= \frac{P_0}{P_1} p' \end{aligned} \tag{4}$$

Figures 37, 38, and 39 demonstrate how this correction collapses the test results. All following acoustic pressures presented in this report will be the normalized acoustic pressure.

Setting the takeoff gross weight to be heavier than the target gross weight allowed the aircraft to sweep through the target C_W as fuel was used and yielded a large C_W range. Figures 40 through 48 show the averaged main rotor pulses for a C_W range. The midrange is defined as the nominal C_W ±5%. The upper range is all runs above the midrange and the lower is all runs below the midrange. An indication of 0 runs means that no data was acquired for some of the C_W ranges.

The aircraft parameters of gross weight (GW), true airspeed (TAS), weight coefficient (C_W), advance ratio (μ), advancing tip Mach number (M_{AT}), and effective hover tip Mach number (M_{H_e}) for all AS350 SD1 V condition test points are shown in Figures 49 through 66. As mentioned previously, the V2, V4, and V6 conditions had target C_W and M_{H_e} values. These are shown in the appropriate figures as a gray box for the C_W target range and a magenta line for the target M_{H_e}.

In addition to the altitude variation flight conditions, V1-V6, limited steady-state source noise data at other level flight and descending flight conditions were collected. Figure 67 shows true airspeed versus flight path angle for all steady-state source conditions collected at the three test sites with the run number being shown beside the data point. Figure 68 shows the aircraft parameters for these test points. Figures 69 through 102 show the Lambert projections of the integrated noise levels for a) OASPL (integrated over 0 to 6000 Hz) and b) BVISPL (integrated over the 5th through 50th harmonics, 98.5 to 985 Hz). The Lambert projection allows a minimally distorted picture of the external noise radiation pattern. The center of the plot, marked with an elevation angle of -90° represents the underside of the hemisphere. The edges with a 0° elevation represent noise radiated in the horizon plane. Azimuth angles start at 0° behind the helicopter, and progress clockwise such that the advancing rotor is at 90° per convention. The decibel levels in these plots are for a distance of 100 feet from the center of the aircraft and have been corrected for spherical spreading; ground board installation effects have been removed.

The levels have been normalized to account for the altitude effects. Note that the main rotor spins in a clockwise direction for the AS350 SD1.

8 EH-60L Results

The EH-60L flew a total of 69.2 hours, including 38 hours flown over the test sites with 877 data runs acquired. This section will present an overview of the aircraft data from all phases of the testing of the EH-60L aircraft. Acoustic results will be presented in a forthcoming classified report. Flight cards for the EH-60L are listed in Tables 35 through 37 for Sweetwater, Tables 38 through 43 for Amedee, and Tables 44 through 46 for Salton Sea. Flight track repeatability between runs at each test site is shown in Figures 103 through 105. The flight track had a larger than anticipated y-variation for the Sweetwater runs and the first part of the Amedee testing. An error in the guidance was found and fixed midway through the Amedee testing, improving tracking to permit holding to ±50 feet in the y-direction and ±100 feet in the z-direction for the descent track in almost all cases. The descent angle was repeatable and constant during the test points even when there was a large offset in y.

Figure 106 shows the relationship between M_{H_e} and M_{AT}. Figures are presented as a function of M_{AT} since that is the metric more commonly used in the industry. Figure 107 shows the advance ratio versus advancing tip Mach number for the V7 through V12 test conditions at all three sites. Figure 108 shows the weight coefficient (C_W) versus advancing tip Mach number (M_{AT}) for the same test points. The desired advancing tip Mach number (M_{AT}), advance ratio(μ), and weight coefficient (C_W) are plotted as vertical or horizontal lines on the figures. Varying the indicated airspeed and rotor RPM in response to current ambient conditions was effective with the nondimensionally defined conditions being tightly clustered about the desired points.

The aircraft parameters of gross weight (GW), true airspeed (TAS), weight coefficient(C_W), advance ratio (μ), advancing tip Mach number (M_{AT}), and effective hover tip Mach number (M_{H_e}) for all EH-60L V-condition test points are shown in Figures 109 through 126.

In addition to the altitude variation test points, speed sweeps from 50 to 150 knots at level flight and flight path angles from -12° to +3° were performed at Amedee to fully characterize the source noise of the EH-60L. Figure 127 shows the true airspeed vs flight path angle for all points taken and lists the run number for each of these points. Figures 128 through 131 show the level flight L-condition average parameters. Figures 132 through 136 show the source A-condition average parameters.

As mentioned previously, a series of maneuvers was performed on the EH-60L at the Amedee test site. The aircraft parameters relevant to the type of maneuver performed for all the M-condition test points are shown in Figures 137 through 180. Each of these figures contains all test points for that condition number. For example, Figure 137 contains all test points flown for condition M1.

The steady turn condition aircraft parameters are shown in Figures 181 through 206. These plots show the y position, true airspeed and bank angle as a function of x for each of the test points flown. Also shown is the projection of the microphone position on a hemisphere as the aircraft flies the ground track. Note that 0° elevation on these hemispheres is in the horizontal plane. These projections show that there is good coverage on the hemisphere, even though the aircraft had difficulty flying the defined ground track, demonstrating the robustness of the testing technique.

9 Electronic Data Description

The AS350 SD1 data described in this paper are open and available electronically. However, the EH-60L aircraft data are limited distribution and the acoustics data are classified Confidential. These data are available with permission of the Utility Helicopters Project Management Office, 256-955-8938. The request for data for both aircraft should be directed to Eric Greenwood, Aeroacoustics Branch (D314), Mail Stop 461, NASA Langley Research Center, 23681, eric.greenwood@nasa.gov. The data are provided in standard American Standard Code for Information Interchange (ASCII) text, Microsoft Excel, MATLAB® MAT and/or Network Common Data Format (NetCDF) formats, depending on data type. NetCDF is a "self-describing", packed binary format, which is platform independent. Drivers for a multitude of platforms are available at no cost at http://www.unidata.ucar.edu/software/netcdf/. The file structure for the electronic data is shown in Figure 207. Descriptions of the contents of each file type, including file naming convention and file format, are contained in the following subsections. To ensure the relationship between files is maintained, the file structure under and including the `AltVarDataForDistribution` should be put into the MATLAB path. The script `addPathsScript` can be executed to perform this function.

9.1 Reference Files

There is a Microsoft® Excel formatted spreadsheet for each aircraft at each location. The filename format for these files is `AltVaraaaaalllllRefList.xlsx` where `aaaaa` is the aircraft name and `lllll` is the location name. Each of these files contains general information for each run of that aircraft and that location. For example, the file `AltVarAS350AmedeeRefList.xlsx` is the reference file for the AS350 SD1 data acquired at the Amedee test site. Table 47 shows the information contained in each of these files. The reference files have the mapping of the NASA numbering convention to the Army numbering convention where appropriate.

9.2 Acoustic Pressure Time History Data

Acoustic pressure time history data, in units of pascals, are in the NetCDF binary files contained in the aaaaaAcousticData/lllll_aaaaa_Acoustic folders with lllll being the locations of Amedee, SaltonSea, and Sweetwater and aaaaa being AS350 or EH60L. Figure 207 does not show the EH60L acoustic data folders, as those data are only contained in the classified data release. Within each of these directories are NetCDF files containing the acoustic data in pascals. The filename format is fffrrr_mm_pascal.nc where fff is the NASA flight number, rrr is the NASA run number, and mm is the microphone number. For example, file 301100_08_pascal.nc is the file containing the acoustic pressure time history data in pascals for NASA flight number 301, NASA run number 100 and microphone number 8. Table 48 describes the variables contained in the acoustic pressure time history files. Note that the acoustic pressure in these files is uncorrected for installation effects.

9.3 Microphone Location Files

The microphone GPS locations for each site are contained in the comma delimited text files Sweetwater_Surveyed_Mics.csv, Amedee_Surveyed_Mics.csv, and SaltonSea_Surveyed_Mics.csv. These files have a row for each microphone which contains the microphone number, latitude, and longitude in decimal degrees, ellipsoid height in meters and an installation type keyword. The installation type for all microphone installations for these tests is invgb7 for inverted 7 mm over a ground board.

9.4 Aircraft Data Files

Data from the aircraft are contained in folders lllll_aaaaa_inflight_processed where lllll is either Sweetwater, Amedee or SaltonSea. The aaaaa field is either AS350 or EH60L. Thus, the SaltonSea_AS350_inflight_processed folder contains all the inflight data for the AS350 SD1 taken at Salton Sea. There is one comma delimited text file for each run number. However, each aircraft's inflight file has its own contents. The naming convention for the AS350 SD1 files is Nfffrrr.csv where fff is the NASA flight number and rrr is the NASA run number. Table 49 lists the columns for the inflight files for the AS350 SD1. Note that the x, y, and z listed in these files are in the rotated coordinate system where (0,0,0) is at the reference microphone (number 11). The naming convention for the EH-60L inflight data files is FdddRooo_Proc.csv where ddd is the Army flight number and ooo is the Army record number. For example, F362R001_Proc.csv contains the inflight data for Army flight 362 and Army run number 001. Table 50 lists the columns for the inflight files for the EH-60L.

9.5 Weather Data Files

The weather data for each test site are contained in the folder `lllll_processed_weather` where `lllll` is either Sweetwater, Amedee or SaltonSea. There are individual files for each of the four types of weather instrumentation. Altitudes listed in the weather files that are labeled as "Rel" are in relation to the reference microphone location for that site. Thus, a "Rel" reading of 42 feet is 42 feet above that reference and not the elevation of the ground at the weather instrumentation measurement location. Altitudes labeled as "AGL" are heights above the ground at that instrument measurement location. In general, if the variable has a second column, then the first column is the average value and the second column is the standard deviation throughout the run. The locations for the weather instrumentation for each site are located in Tables 22 through 24.

9.5.1 Weather Balloon Sonde

The data from the weather sonde mounted just below the tethered balloon is located in the `lllllll_BalloonSonde_Readings.mat` files where the `lllll` is the site location. This file contains a data structure named BalloonSonde whose fields are described in Table 51.

9.5.2 Weather Sondes on Balloon Tether

The data from the weather sondes located along the balloon tether are located in the `lllll_WeatherSonde_Readings.mat` files where the `lllll` is the site location. This file contains a data structure vector named WeatherSonde whose fields are described in Table 52. Only those sondes that were deployed and worked are included in each site's file.

9.5.3 Weather Stations

The data from the weather stations located in the measurement field are located in the `lllll_WeatherStation_Readings.mat` files where the `lllll` is the site location. This file contains a data structure vector named WeatherStation whose fields are described in Table 53. Only those sondes that were deployed and worked are included in each site's file.

9.5.4 LIDAR

The data from the LIDAR are located in the `lllll_LIDAR_Readings.mat` files where the `lllll` is the site location. This file contains a data structure named LIDAR whose fields are described in Table 54.

9.5.5 Wind Profile

Data from the available instruments that measure wind are amalgamated into one comma delimited .csv file, which contains the averaged wind speed and direction as a function of height above the reference for each run number. The averaging period is the time of acoustic data acquisition. The naming convention for this file is `lllll_WindProfile.csv` where the `lllll` is the site location. The first column is the NASA combined run number. Columns 2 through 13 are the altitude in feet of the reading relative to the reference microphone for that location. Wind speeds in knots are in columns 14 through 25, and columns 26 through 37 are the wind directions in °True. If a value is not available, then "NaN" is entered.

9.5.6 Temperature Profile

The temperature profile file contains the comma delimited temperature profiles from the combined weather balloon sonde and weather station data. The naming convention for this file is `lllll_TempProfile.csv` where the `lllll` is the site location. The first column is the NASA combined run number. Columns 2 through 7 are the altitudes in feet of the readings relative to the reference microphone for that location. Columns 8 through 13 are the temperature readings in °F. The value "NaN" is used if no data were available for that position.

9.5.7 Pressure Profile

The pressure profile file contains the comma delimited static pressure profiles from the combined weather balloon sonde and weather station data. The naming convention for this file is `lllll_PresProfile.csv` where the `lllll` is the site location. The first column is the NASA combined run number. Columns 2 through 7 are the altitudes in feet of the readings relative to the reference microphone for that location. Columns 8 through 13 are the pressure readings in kPa. The value "NaN" is used if no data were available for that position.

9.6 Test Logs

The test logs recorded each day of testing are in Microsoft® Excel format and are located in folders named `lllll_aaaaa_logs` where `lllll` is the site location and `aaaaa` is the aircraft. This information is also contained in the reference files and in the test card Tables but is included electronically for completeness.

9.7 Included MATLAB® Functions

A set of MATLAB® utility functions is included in the electronic distribution that are used to load the various data sets.

- `loadAS350` is the top level function that loads all the AS350 SD1 reference, inflight, microphone location, and weather data for the specified NASA combined run number. This routine does not load the acoustics data.
- `loadEH60L` is the top level function that loads all the EH-60L reference, inflight, microphone location, and weather data for the specified NASA combined run number. This routine does not load the acoustics data.
- `netCDFimport` is used to import the netCDF formatted acoustic data. This routine must be called once for each microphone.
- `micConvert` is used to read the microphone coordinate file and generate the microphone locations in a LEN Cartesian coordinate system centered at an input reference location with +ex in the easterly direction and +ey in the northerly direction.
- `loadMicFile` reads in the microphone location coordinates.
- `gps_to_len` converts the GPS coordinates to LEN coordinates centered on a defined reference position.
- `coordtransform` is used to rotate that LEN coordinate system to point the +x axis in the desired direction.
- `array_coord_v2` combines the functions of `gps_to_len` and `coordtransform` and generates x, y, and z as well as LEN coordinates given GPS lat, lon, ellipsoid inputs.
- `loadAltVarRefInfo` reads in the information in the reference file for the defined NASA combined run number.
- `importAS350inflight` loads the inflight data from the AS350 SD1 for the defined NASA combined run number.
- `importEH60Linflight` loads the inflight data from the EH-60L for the defined NASA combined run number.
- `hemigenS` generates the phi and azimuth values for a NASA combined run number.
- `loadWeather` reads all the weather information for the specified NASA combined run number.

10 Concluding Remarks

A cooperative flight test campaign between NASA and the U.S. Army was performed between September 2014 and February 2015. The purposes of the testing were to: investigate the effects of altitude variation on noise generation, investigate the effects of gross weight variation on noise generation, establish the statistical variability in acoustic flight testing of helicopters, and characterize the effects of transient maneuvers on radiated noise for a medium-lift utility helicopter. This test was performed at three sites (Salton Sea, 0 feet AMSL; Amedee, 4000 feet AMSL; and Sweetwater, 7000 feet AMSL). Two aircraft (AS30 SD1 and EH-60L) were tested at each site. A total of 135 flight hours were flown with 65.5 of those being data acquisition hours used to acquire 1510 data points. This report has described the test sites, aircraft, instrumentation, conditions flown, data acquired and stored data formats. Additionally, overview acoustics data for the AS350 SD1 were presented. All aircraft and AS350 SD1 acoustic electronic data are publicly available upon request. The EH-60L electronic acoustic data are available upon permission of the U.S. Army Utility PM office.

References

1. D. A. Boxwell, F. H. Schmitz, W. R. Splettstoesser, and K. J. Schultz, "Model Helicopter Rotor High-Speed Impulsive Noise: Measured Acoustics and Blade Pressures," Tech. Rep. NASA TM 85850, Sep. 1983.

2. E. Greenwood and F. H. Schmitz, "Effects of Ambient Conditions on Helicopter Rotor Source Noise Modeling," *Journal of Aircraft*, vol. 51, no. 1, pp. 90–103, Jan. 2014.

3. E. Greenwood, "Fundamental Rotorcraft Acoustic Modeling From Experiments (FRAME)," Ph.D. Thesis, University of Maryland, College Park, MD, January 2011.

4. "Ground-Plane Microphone Configuration for Propeller-Driven Light-Aircraft Noise Measurement," SAE, ARP 4055, November 2007.

5. G. Gopalan and F. H. Schmitz, "Far-Field Near-In-Plane Harmonic Main Rotor Helicopter Impulsive Noise Reduction Possibilities," in *American Helicopter Society 64th Annual Forum*, 2008.

6. M. E. Watts, E. Greenwood, C. D. Smith, R. Snider, and D. A. Conner, "Maneuver Acoustic Flight Test of the Bell 430 Helicopter Data Report," NASA, TM 2014-218266, May 2014.

Tables

Table 1: Aircraft Specifications.

	AS350 SD1	EH-60L
Main Rotor Diameter	35.07 ft	53.67 ft
Num. Main Rotor Blades	3	4
MR RPM, BPF	394 RPM, 19.7 Hz	258 RPM, 17.2 Hz
Tail Rotor Diameter	6.1 feet	11 feet
Num. Tail Rotor Blades	2	4
TR RPM, BPF	2086 RPM, 69.5 Hz	1190 RPM, 79.3 Hz
Empty Weight	2,690 lb	10,624 lb
Max Take Off GW	4,960 lb	23,500 lb
Main Rotor Rotation Direction	Clockwise	Counter Clockwise

Table 2: ANTS File Contents.

Column	Variable Name	Description	Units
1	Flag	Output type flag	
2	Time	GPS time of week	sec
3	Week	GPS week	week
4	Status	Status for INS filter	
5	Heading	Heading angle relative to true north	deg
6	Pitch	Pitch angle relative to horizon	deg
7	Roll	Roll angle relative to horizon	deg
8	Latitude	INS solution position in geodetic latitude	deg
9	Longitude	INS solution position in geodetic longitude	deg
10	Altitude	Height above ellipsoid (WGS84)	m
11	NedVelX	INS solution velocity in NED frame (North)	m/sec
12	NedVelY	INS solution velocity in NED frame (East)	m/sec
13	NedVelZ	INS solution velocity in NED frame (Down)	m/sec
14	AttUncertainty	Uncertainty in attitude estimate	deg
15	PosUncertainty	Uncertainty in position estimate	m
16	VelUncertainty	Uncertainty in velocity estimate	m/sec
17	Checksum	Check sum	

Table 3: Data Logger File Contents.

Column	Variable Name	Description	Units
1	Timestamp	Do not use	
2	TZ	Do not use	
3	Dynamic Pressure		V
4	OAT	Boom outside air temperature	Ohms
5	Alpha	Boom alpha	V
6	Beta	Boom beta	V
7	LiPo Battery	Battery voltage	V
8	GPS Time	GPS time of week	sec
9	GPS Week	GPS week	week
10	GPS Fix	GPS status code	
11	GPS Sats	Number GPS satellites	
12	GPS Lat	GPS latitude from ANTS	deg
13	GPS Lon	GPS longitude from ANTS	deg
14	GPS WGS84	Direct GPS altitude	m
15	North Vel	Direct North velocity from ANTS	m/sec
16	East Vel	Direct East velocity from ANTS	m/sec
17	Down Vel	Direct Down velocity from ANTS	m/sec
18	North Acc	North GPS accuracy from ANTS	m
19	East Acc	East GPS accuracy from ANTS	m
20	Vert Acc	Vertical GPS accuracy from ANTS	m
21	Speed Acc	Velocity GPS accuracy from ANTS	m/sec
22	Time Acc	GPS time accuracy from ANTS	sec

Table 4: ADS Signal List (ANALOG Group, Sample Rate: Continuous).

No.	Col	ADS Name	unc3	interp.	Description	Units
1	A	ADS time	TIME	TIME	GPS time stamp, analog data	sec
2	B	AT1	AT1		ADS temp 1	deg F
3	C	AT2	AT2		ADS temp 2	deg F
4	D	D100	D100	iD100	longitudinal stick	%
5	E	D101	D101	iD101	lateral stick	%
6	F	D102 *	D103	iD103	collective	%
7	G	D103 *	D102	iD102	pedal	%
8	H	DM00	DM00	iDM00	longitudinal mixer input	%
9	I	DM01	DM01	iDM01	lat mixer input	%
10	J	DM02	DM02	iDM02	directional mixer input	%
11	K	DP01	DP01	iDP01	lateral primary servo	%
12	L	DP00	DP00	iDP00	forward primary servo	%
13	M	DP03	DP03	iDP03	aft primary servo	%
14	N	DS00	DS00	iDS00	longitudinal SAS output	%
15	O	DS01	DS01	iDS01	lateral SAS output	%
16	P	DS02	DS02	iDS02	directional SAS output	%
17	Q	D003	D003	iD003	stabilator position	deg
18	R	DAA0	DAA0	iDAA0	boom AOA	deg
19	S	DSS0	DSS0	iDSS0	boom sideslip	deg
20	T	R021	R021	iR021	tail rotor impress pitch	%

Continued on next page

Table 4: *continued.*

No.	Col	ADS Name	unc3	interp.	Description	Units
26	Z	H001	H001	iH001	boom static pres	in Hg
27	AA	V001	V001	iV001	boom dynamic pres	in Hg
28	AB	T100	T100	iT100	OAT (total temp)	deg F
29	AC	H003	H003	iH003	radar altimeter	ft
30	AD	WFVOL1	iff1	iff1	Engine 1 fuel	lb
31	AE	WFVOL2	iff2	iff2	Engine 2 fuel	lb
32	AF	CDP1	P31	ip31	Eng 1 compressor discharge pres	psig
33	AG	CDP2	P32	ip32	Eng 2 compressor discharge pres	psig
34	AH	Q1	Q1	iq1	Eng 1 torque (100% = 1414 shp)	%
35	AI	Q2	Q2	iq2	Eng 2 torque (100% =1414 shp)	%
38	AL	Nr	NR	inr	Main rotor RPM (100% = 257.891 rpm)	%
39	AM	Np1	NP1	inp1	Eng 1 power turbine speed	%
40	AN	Ng1	NG1	ing1	Eng 1 compressor speed	%
41	AO	Np2	NP2	inp2	Eng 2 power turbine speed	%
42	AP	Ng2	NG2	ing2	Eng 2 compressor speed	%
46	AT	MGT1	MGT1	imgt1	Eng 1 measured gas temp (T 4.5)	deg C
47	AU	MGT2	MGT2	imgt2	Eng 2 measured gas temp (T 4.5)	deg C

Table 5: ADS Signal List (I01 Group, Sample Rate: 50 Hz).

No.	Col	ADS Name	unc3	interp.	Description	Units
75	BW	ADS time	T I01		GPS time stamp, I01 data	sec
76	BX	inumode I01	mode1		mode word for I01	
77	BY	tim I01	time1		INU time tag for I01	μ sec
78	BZ	vxnav1	vxnav1	ivxnav1	nav axes x-vel @ INU	fps
79	CA	vynav1	vynav1	ivynav1	nav axes y-vel @ INU	fps
80	CB	vznav1	vznav1	ivznav1	nav axes z-vel @ INU	fps
81	CC	plataz1	plataz1	iplataz1	platform azimuth	pi rad
82	CD	phi1	phi1	iphi1	roll angle	pi rad
83	CE	theta1	theta1	itheta1	pitch angle	pi rad
84	CF	psi1	psi1	ipsi1	true heading	pi rad
85	CG	psimag1	psimag1	ipsimag1	magnetic heading	pi rad
86	CH	vxdnav	axnav1	iaxnav1	nav axes x acceleration at INU	fps2
87	CI	vydnav	aynav1	iaynav1	nav axes y acceleration at INU	fps2
88	CJ	vzdnav	aznav1	iaznav1	nav axes z acceleration at INU	fps2
89	CK	cnexx	cnexx	icnexx	cnexx	
90	CL	cnexy	cnexy	icnexy	cnexy	
91	CM	cnexz	cnexz	icnexz	cnexz	
92	CN	inu lon	loninu	iloninu	longitude	pi rad
93	CO	altinu	altinu1	ialtinu1	inertial altitude	ft
94	CP	gce	gce	igce	great circle steering error	pi rad

Continued on next page

Table 5: *continued.*

No.	Col	ADS Name	unc3	interp.	Description	Units
95	CQ	xtilt	xtilt	ixtilt	x-axis platform tilt	arcsec
96	CR	ytilt	ytilt	iytilt	y-axis platform tilt	arcsec
97	CS	mdwrd 2	mode2	imode2	mode word 2	
98	CT	pb1	pb1	ipb1	roll rate	pi rad/sec
99	CU	qb1	qb1	iqb1	pitch rate	pi rad/sec
100	CV	rb1	rb1	irb1	yaw rate	pi rad/sec

Table 6: ADS Signal List (I09 Group, Sample Rate: 200 Hz).

No.	Col	ADS Name	unc3	interp.	Description	Units
101	CW	ADS time	T I09		GPS time stamp, I09 data	sec
102	CX	inumode I09	mode9		mode word for I09	
103	CY	tim I09	time9		INU time tag for I09	μ sec
104	CZ	vxnav9	vxnav9	ivxnav9	nav axes x-velocity @ INU	fps
105	DA	vynav9	vynav9	ivynav9	nav axes y-velocity @ INU	fps
106	DB	vznav9	vznav9	ivznav9	nav axes z-velocity @ INU	fps
107	DC	plataz9	plataz9		platform azimuth	pi rad
108	DD	phi9	phi9	iphi9	roll	pi rad
109	DE	theta9	theta9	itheta9	pitch	pi rad
110	DF	pb9	pb9	ipb9	roll rate	pi rad /sec
111	DG	qb9	qb9	iqb9	pitch rate	pi rad /sec
112	DH	rb9	rb9	irb9	yaw rate	pi rad /sec
113	DI	ax	axb	iaxb	body axes x-acceleration @ INU	fps2
114	DJ	ay	ayb	iayb	body axes y-acceleration @ INU	fps2
115	DK	az	azb	iazb	body axes z-acceleration @ INU	fps2
116	DL	plataztime9	tplataz9		time tag, platform azimuth	μ sec
117	DM	rolltime9	tphi9		time tag, roll angle	μ sec
118	DN	pitchtime9	ttheta9		time tag, pitch angle	μ sec
119	DO	pbd9	pbd9	ipbd9	angular acceleration, roll	pi rad/sec2
120	DP	qbd9	qbd9	iqbd9	angular acceleration, pitch	pi rad/sec2

Continued on next page

Table 6: *continued.*

No.	Col	ADS Name	unc3	interp.	Description	Units
121	DQ	rbd9	rbd9	irbd9	angular acceleration, yaw	pi rad/sec2
122	DR	ADS time	T IH1		GPS time stamp, IH1 message	sec
123	DS	phih1 *	thetah1	ithetah1	pitch angle	pi rad
124	DT	thetah1 *	phih1	iphih1	roll angle	pi rad
125	DU	psi9 *	psih1	ipsih1	true heading	pi rad
126	DV	nsvel	vn	ivn	North velocity @ INU	fps
127	DW	ewvel	ve	ive	East velocity @ INU	fps
128	DX	zvel	vd	ivd	down velocity @ INU	fps
129	DY	platazIh1	platazh1		platform azimuth	pi rad
130	DZ	vxnavh1	vxnavh1	ivxnavh1	nav axis x-vel @ INU	fps
131	EA	vynavh1	vynavh1	ivynavh1	nav axis y-vel @ INU	fps
132	EB	vznavh1	vznavh1	ivznavh1	nav axis z-vel @ INU	fps
133	EC	veltime	tvelh1		time tag, velocity	μ sec
134	ED	plataztimeh1	tazh1		time tag, platform azimuth	μ sec
135	EE	rolltimeh1	tphih1		time tag, roll angle	μ sec
136	EF	pitchtimeh1	tptchh1		time tag, pitch angle	μ sec

Table 7: ADS Signal List (DGPS Group, Sample Rate: 10 Hz).

No.	Col	ADS Name	unc3	interp.	Description	Units
137	EG	Ashtech time	T ASH		GPS time stamp, DGPS data	sec
138	EH	ash1	ashmode	iashmode	Raw/Differential Position	0 Raw 1 diff w/RTCM 2 diff w/CPD 3 CPD fixed sol
139	EI	ash2	ashsats	iashsats	Number of SVs used	
140	EJ	ash3	ashtfix	iashtfix	UTC Time of position fix	hhmmss.ss
141	EK	ash4 (dd.mm.mmmm)	ashlat	iashlat	Latitude, deg	dd.mmmmmm
142	EL	ash5 (dd.mm.mmmm)	ashlon	iashlon	Longitude, deg	ddd.mmmmmm
143	EM	ash6	ashalt	iashalt	Altitude	ft
144	EN	ash7	ashtrk	iashtrk	Course over Ground	deg
145	EO	ash8	ashvgr	iashvgr	Speed over Ground	kt
146	EP	ash9	ashzd	iashzd	Vertical Velocity	fps
147	EQ	PDOP	pdop		Position dilution of precision	
148	ER	HDOP	hdop		Horizontal dilution of precision	
149	ES	VDOP	vdop		Vertical dilution of precision	
150	ET	TDOP	tdop		Time dilution of precision	
151	EU	Lat Hi	lat hi		Latitude high segment	
152	EV	Lat Lo	lat lo		Latitude low segment x 106	
153	EW	Lon Hi	lon hi		Longitude high segment	
154	EX	Lon Lo	lon lo		Longitude low segment x 106	

Table 8: AS350 SD1 Altitude Variation V Condition Codes.

Condition Code	KIAS	FPA °	Description
V1	80	0	Commanded
V2	80(1)	0	Match M_{H_e} and C_W
V3	105	0	Commanded
V4	105(1)	0	Match M_{H_e} and C_W
V5	80	-6	Commanded
V6	80(1)	-6	Match M_{H_e} and C_W
V16	100	-4.5	Commanded
V17	100(1)	-4.5	Match M_{H_e} and C_W
V18	80	-6	Commanded
V19	80(1)	-6	Match M_{H_e} and C_W

(1) Airspeed determined at time of point acquisition

Table 9: EH-60L Altitude Variation V Condition Codes.

Condition Code	KIAS	FPA °	Description
V7	80	0	Commanded
V8	80(1)	0	Match μ, M_{AT}, and C_W
V9	125	0	Commanded
V10	125(1)	0	Match μ, M_{AT}, and C_W
V11	80	-6	Commanded
V12	80(1)	-6	Match μ, M_{AT}, and C_W
V13	131	0	Match preveiously tested condition of 100.5% N_R, M_H = 0.653, μ = 0.304, M_{AT} = 0.852, C_W = 0.00791, GW = 18500 (only performed at Sweetwater)

(1) Airspeed and RPM determined at time of point acquisition

Table 10: Altitude Variation V Target Conditions.

Parameter	AS350 SD1 Low	AS350 SD1 High	EH-60L Low	EH-60L High
μ	-	-	0.191	0.298
M_H	-	-	0.642	0.642
M_{AT}	-	-	0.764	0.834
M_{H_e}	0.762	0.794	0.731	0.794
C_W	0.00384	0.00384	0.0075	0.0075

Table 11: AS350 SD1 Level Flight Condition Codes.

Condition Code	KIAS
L1	60
L2	70
L3	90
L4	100
L5	V_H
L6	40

Table 12: EH-60L Level Flight Condition Codes.

Condition Code	KIAS	N_R %
L0	V_H	100.5
L1	140	100.5
L2	130	100.5
L3	120	100.5
L4	110	100.5
L5	95	100.5
L6	80	100.5
L7	65	100.5
L8	50	100.5
L9	V_H	96.5
L10	130	96.5
L11	120	96.5
L12	110	96.5
L13	95	96.5
L14	80	96.5
L15	65	96.5
L16	50	96.5

Table 13: AS350 SD1 Descent Flight Condition Codes.

Condition Code	KIAS	FPA °
A1	80	-3.0
A2	80	-9.0
A3	100	-3.0
A4	60	-3.0
A5	60	-6.0
A6	60	-9.0

Table 14: EH-60L Descent Flight Condition Codes.

Condition Code	KIAS	NR %	Sink Rate ft/min	FPA °
A1	110	100.5	585	-3
A2	110	96.5	585	-3
A3	95	100.5	505	-3
A4	95	100.5	1005	-6
A5	95	96.5	505	-3
A6	95	96.5	1005	-6
A7	80	100.5	425	-3
A8	80	100.5	845	-6
A9	80	100.5	1265	-9
A10	80	100.5	1685	-12
A11	80	96.5	425	-3
A12	80	96.5	845	-6
A13	80	96.5	1265	-9
A14	80	96.5	1685	-12
A15	65	100.5	345	-3
A16	65	100.5	690	-6
A17	65	100.5	1030	-9
A18	65	100.5	1370	-12
A19	65	96.5	345	-3
A20	65	96.5	690	-6
A21	65	96.5	1030	-9
A22	65	96.5	1370	-12
A23	50	100.5	265	-3
A24	50	100.5	530	-6
A25	50	100.5	790	-9
A26	50	100.5	1055	-12
A27	50	96.5	265	-3
A28	50	96.5	530	-6
A29	50	96.5	790	-9
A30	50	96.5	1055	-12
A31	80	100.5	-425	3
A32	80	96.5	-425	3
A33	80	100.5	-845	6
A34	80	96.5	-845	6

Table 15: EH-60L Steady Turn Condition Codes.

		Bank Angle	
KIAS	Direction	15°	30°
65	Left	S3	S4
	Right	S1	S2
95	Left	S7	S8
	Right	S5	S6

Table 16: EH-60L Constant Speed Banks.

		Bank Angle	
KIAS	Direction	20°	30°
65	Left	M9	M12
	Right	M3	M6
80	Left		M44
	Right		M43
95	Left	M8	M11
	Right	M2	M5
110	Left	M7	M10
	Right	M1	M4

Note: Approach level at constant speed then bank at -2000 ft

Table 17: EH-60L Quick Stop.

KIAS	Aggression	
95	Moderate	M13
	Aggressive	M14

Table 18: EH-60L Accelerating and Decelerating Banks.

Aggression	Direction	80 KIAS Start Accel	120 KIAS Start Decel
Moderate	Left	M20	M24
	Right	M18	M22
Aggressive	Left	M21	M25
	Right	M19	M23

Note: Initiate accel/decel at -3000 then bank at -2000 ft

Table 19: EH-60L Climbing Turns.

KIAS	Direction	Flight Path Angle 3°	6°
80	Left	M27	M33
	Right	M26	M32
95	Left	M29	M35
	Right	M28	M34
110	Left	M31	M37
	Right	M30	M36

Note: Initiate climb at -3000 ft then bank at -2000 ft

Table 20: EH-60L Maneuver Condition Codes.

Condition Code	KIAS	N_R %	FPA °	Comment
M1	110	100.5	0	Level flight 90° right turn at a 20° bank angle at (1)
M2	95	100.5	0	Level flight 90° right turn at a 20° bank angle at (1)
M3	65	100.5	0	Level flight 90° right turn at a 20° bank angle at (1)
M4	110	100.5	0	Level flight 90° right turn at a 30° bank angle at (1)
M5	95	100.5	0	Level flight 90° right turn at a 30° bank angle at (1)
M6	65	100.5	0	Level flight 90° right turn at a 30° bank angle at (1)
M7	110	100.5	0	Level flight 90° left turn at a 20° bank angle at (1)
M8	95	100.5	0	Level flight 90° left turn at a 20° bank angle at (1)
M9	65	100.5	0	Level flight 90° left turn at a 20° bank angle at (1)
M10	110	100.5	0	Level flight 90° left turn at a 30° bank angle at (1)
M11	95	100.5	0	Level flight 90° left turn at a 30° bank angle at (1)
M12	65	100.5	0	Level flight 90° left turn at a 30° bank angle at (1)
M13	95-0	100.5	0	Quick stop at (1), moderately aggressive

1) 2000 ft before primary array

Table 20: *continued.*

Condition Code	KIAS	NR %	FPA °	Comment
M14	95-0	100.5	0	Quick stop ending at (1), aggressive
M15	95	100.5	0	Approach level at (1), pull up, then push over
M16	110	100.5	0	Approach level at (1), pull up, then push over
M17	40-140	100.5	0	Max level flight acceleration at (1)
M18	80 varies	100.5	0	Approach at 100' AGL, establish accel and then start right turn to 30° bank 2000' before primary array, moderate acceleration
M19	80 varies	100.5	0	Approach at 100' AGL, establish accel and then start right turn to 30° bank 2000' before primary array, max acceleration
M20	80 varies	100.5	0	Approach at 100' AGL, establish accel and then start left turn to 30° bank 2000' before primary array, moderate acceleration
M21	80 varies	100.5	0	Approach at 100' AGL, establish accel and then start left turn to 30° bank 2000' before primary array, max acceleration
M22	120 varies	100.5	0	Approach at 100' AGL, establish decel and then start right turn to 30° bank 2000' before primary array, moderate deceleration
M23	120 varies	100.5	0	Approach at 100' AGL, establish decel and then start right turn to 30° bank 2000' before primary array, max deceleration

1) 2000 ft before primary array

Table 20: *continued.*

Condition Code	KIAS	NR %	FPA °	Comment
M24	120 varies	100.5	0	Approach at 100' AGL, establish decel and then start left turn to 30° bank 2000' before primary array, moderate deceleration
M25	120 varies	100.5	0	Approach at 100' AGL, establish decel and then start left turn to 30° bank 2000' before primary array, max deceleration
M26	80	100.5	+3	Approach at 100' AGL, establish climb and then start right turn at 2000' before primary array, constant speed
M27	80	100.5	+3	Approach at 100' AGL, establish climb and start left turn at 2000' before primary array, constant speed
M28	95	100.5	+3	Approach at 100' AGL, establish climb and then start right turn at 2000' before primary array, constant speed
M29	95	100.5	+3	Approach at 100' AGL, establish climb and then start left turn at 2000' before primary array, constant speed
M30	110	100.5	+3	Approach at 100' AGL, establish climb and then start right turn at 2000' before primary array, constant speed
M31	110	100.5	+3	Approach at 100' AGL, establish climb and then start left turn at 2000' before primary array, constant speed
M32	80	100.5	+6	Approach at 100' AGL, establish climb and then start right turn at 2000' before primary array, constant speed

1) 2000 ft before primary array

Table 20: *continued.*

Condition Code	KIAS	NR %	FPA °	Comment
M33	80	100.5	+6	Approach at 100' AGL, establish climb and start left turn at 2000' before primary array, constant speed
M34	95	100.5	+6	Approach at 100' AGL, establish climb and then start right turn at 2000' before primary array, constant speed
M35	95	100.5	+6	Approach at 100' AGL, establish climb and then start left turn at 2000' before primary array, constant speed
M36	110	100.5	+6	Approach at 100' AGL, establish climb and then start right turn at 2000' before primary array, constant speed
M37	110	100.5	+6	Approach at 100' AGL, establish climb and then start left turn at 2000' before primary array, constant speed
M38	80	100.5	0 to +6	(a) Approach level flight, 100 ft AGL, 80 knots, (b) Initiate RIGHT bank (30 deg/sec roll-in rate to 30 deg bank angle) 2000 ft before microphone array, (c) Simultaneously climb (6 deg/sec to 6 deg climb angle), (d) Maintain 80 knots throughout 1 second transition, (e) Steady climb-out at 80 knots, 30 deg bank angle and 6 deg climb angle over 10 seconds

1) 2000 ft before primary array

Table 20: *continued.*

Condition Code	KIAS	NR %	FPA °	Comment
M39	80	100.5	0 to +6	(a) Approach level flight, 100 ft AGL, 80 knots, (b) Initiate LEFT bank (30 deg/sec roll-in rate to 30 deg bank angle) 2000 ft before microphone array, (c) Simultaneously climb (6 deg/sec to 6 deg climb angle), (d) Maintain 80 knots throughout 1 second transition, (e) Steady climb-out at 80 knots, 30 deg bank angle and 6 deg climb angle over 10 seconds.
M40	80 to 50	100.5	0	(a) Approach microphone array, level flight, 100 ft AGL, 80 knots, (b) Initiate RIGHT bank (30 deg/sec roll-in rate to 30 deg bank angle) 2000 ft before microphone array, (c) Simultaneously decelerate from 80 knots at 0.15g (equiv. to -2.86 knots/sec) to 50 knots over about 10 seconds, (d) Maintain level flight at 200 ft AGL throughout maneuver.
M41	80 to 50	100.5	0	(a) Approach microphone array, level flight, 100 ft AGL, 80 knots, (b) Initiate LEFT bank (30 deg/sec roll-in rate to 30 deg bank angle) 2000 ft before microphone array, (c) Simultaneously decelerate from 80 knots at 0.15g (equiv. to -2.86 knots/sec) to 50 knots over about 10 seconds, (d) Maintain level flight at 200 ft AGL throughout maneuver.

1) 2000 ft before primary array

Table 20: *continued.*

Condition Code	KIAS	NR %	FPA °	Comment
M42	80	100.5	0 to +6	(a) Approach microphone array, level flight, 100 ft AGL, 80 knots, (b) climb (6 deg/sec to 6 deg climb angle), (c) Maintain 80 knots throughout 1 second transition, (d) Steady climb-out at 80 knots, 30 deg bank angle and 6 deg climb angle over 10 seconds (similar to M38 but without roll)
M43	80	100.5	0	Level flight 90° right turn at a 30° bank angle at (1)
M44	80	100.5	0	Level flight 90° left turn at a 30° bank angle at (1)
M45	110	100.5	0	Level flight, 150 ft AGL along primary microphone array road from West to East
M46	110	96.5	0	Level flight, 150 ft AGL along primary microphone array road from West to East

1) 2000 ft before primary array

Table 21: Altitude Variation Test Run Summary.

Site	AC	Date	NASA Flight	NASA Runs	Army Flight	Army Runs	Nom TOGW	Data Type
Sweet-water (7000')	AS350	9/30/14	273	100 - 166	-	-	4400	V
		10/1/14	274	167 - 224	-	-	3915	V
		10/2/14	275	225 - 265	-	-	3915	V, L
	EH-60L	10/6/14	279	500 - 555	358	1 - 56	18500	V
		10/7/14	280	600 - 629	359	1 - 30	16500	V
		10/8/14	281	700 - 755	361	1 - 55	16500	V
Amedee (4000')	AS350	10/28/14	301	100 - 182	-	-	4090	V,L
		10/29/14	302	200 - 296	-	-	4400	V
		10/30/14	303	300 - 376	-	-	4650	V
	EH-60L	11/6/14	310	100 - 129	362	1 - 31	18500	V
		11/6/14	310	130 - 173	363	1 - 44	18500	V, M
		11/7/14	311	174 - 210	364	1 - 37	18500	M
		11/7/14	311	211 - 243	365	1 - 33	18500	M
		11/8/14	312	244 - 273	366	1 - 30	18500	L
		11/8/14	312	274 - 321	367	1 - 48	18500	V
		11/10/14	314	322 - 353	368	1 - 32	18500	L, A
		11/10/14	314	354 - 389	369	1 - 36	18500	L, A
		11/11/14	315	390 - 427	370	1 - 38	18500	A
		11/11/14	315	428 - 471	371	1 - 44	18500	A
		11/12/14	316	472 - 518	372	1 - 47	18500	M
		11/12/14	316	519 - 576	373	1 - 58	18500	M
		11/14/14	318	577 - 619	375	1 - 42	18500	M, S
		11/14/14	318	620 - 651	376	1 - 32	18500	M
Salton Sea (0')	EH-60L	2/7/15	38	101 - 118	388	1 - 18	21350	V
		2/7/15	38	119 - 147	389	2 - 30	21350	V
		2/7/15	38	148 - 160	390	1 - 13	21350	V
		2/8/15	39	201 - 223	391	1 - 23	18500	V
		2/8/15	39	224 - 256	392	1 - 33	18500	V
		2/8/15	39	257 - 264	393	1 - 8	18500	V
		2/9/15	40	301 - 326	394	1 - 28	16500	V
		2/9/15	40	327 - 359	395	1 - 34	16500	V
	AS350	2/13/15	44	401 - 469	-	-	4630	V
		2/14/15	45	501 - 552	-	-	4630	V, A
		2/14/15	45	553 - 571	-	-	4400	V, L
		2/15/15	46	601 - 650	-	-	4400	V
		2/16/15	47	701 - 720	-	-	4400	V

Table 22: Sweetwater Positions.

Mic Number	Latitude	Longitude	Elipsoid Height Feet	LEN ex Feet	LEN ey Feet	x Feet	y Feet	z Feet
1	38.50358657	-119.23786470	7087.3	-1506.0	-281.8	-0.2	1532.1	93.5
2	38.50394018	-119.23503980	7035.6	-697.6	-153.1	-22.3	713.8	41.7
3	38.50412940	-119.23412720	7019.8	-436.4	-84.2	-2.5	444.4	25.9
4	38.50418411	-119.23368390	7012.4	-309.5	-64.2	-6.3	316.1	18.5
5	38.50422270	-119.23341120	7008.1	-231.5	-50.2	-6.8	236.8	14.3
6	38.50425216	-119.23321150	7004.4	-174.3	-39.4	-6.7	178.6	10.6
7	38.50429634	-119.23306690	7001.8	-133.0	-23.4	1.5	135.0	7.9
8	38.50431197	-119.23292410	6999.7	-92.1	-17.7	-0.4	93.8	5.8
9	38.50433903	-119.23279850	6997.1	-56.1	-7.8	2.6	56.6	3.2
10	38.50435254	-119.23269610	6995.5	-26.8	-2.9	2.1	26.9	1.6
11 (ref)	38.50436048	-119.23260230	6993.9	0.0	0.0	0.0	-0.0	0.0
12	38.50438644	-119.23250580	6992.3	27.6	9.5	4.2	-28.9	-1.6
13	38.50439970	-119.23239840	6990.7	58.4	14.3	3.3	-60.0	-3.2
14	38.50441131	-119.23228700	6988.6	90.2	18.5	1.6	-92.1	-5.3
15	38.50442661	-119.23215740	6987.0	127.3	24.1	0.3	-129.6	-6.9
16	38.50445653	-119.23198840	6984.4	175.7	35.0	2.1	-179.1	-9.5
17	38.50447866	-119.23179300	6981.2	231.6	43.0	-0.3	-235.6	-12.7
18	38.50452301	-119.23151060	6976.5	312.4	59.2	0.8	-318.0	-17.4
19	38.50459616	-119.23107460	6968.5	437.2	85.8	4.0	-445.5	-25.3
20	38.50472848	-119.23016430	6953.2	697.7	134.0	3.5	-710.5	-40.7

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Table 22: *continued.*

Mic Number	Latitude	Longitude	Elipsoid Height Feet	LEN ex Feet	LEN ey Feet	x Feet	y Feet	z Feet
21	38.50514939	-119.22738040	6907.3	1494.4	287.4	7.8	-1521.7	-86.6
24	38.50703916	-119.23327890	6988.1	-193.6	975.6	994.5	11.0	-5.8
27	38.50306122	-119.21329110	6713.0	5526.6	-472.6	-1480.2	-5345.6	-280.9
28	38.50225900	-119.21060110	6677.1	6296.5	-764.6	-1908.7	-6048.7	-316.8
29	38.50259922	-119.21163510	6690.8	6000.5	-640.8	-1732.6	-5780.6	-303.1
LIDAR	38.49624000	-119.23060000	6909.6	573.1	-2957.4	-3012.4	-19.8	-84.8
Balloon	38.50588800	-119.21896800	6875.0	3901.8	556.6	-169.9	-3937.6	-118.9
SWS2	38.50449000	-119.23262000	6993.9	-5.1	47.2	47.3	-3.7	0.0
SWS4	38.50523800	-119.22724900	6907.3	1532.0	319.6	32.6	-1564.6	-86.6
Control	38.50588100	-119.21940000	6878.0	3778.1	554.0	-149.7	-3815.6	-115.9

Note: SWS is a ground weather station

Table 23: Amedee Positions.

Mic Number	Latitude	Longitude	Elipsoid Height Feet	LEN ex Feet	LEN ey Feet	x Feet	y Feet	z Feet
1	40.25613426	-120.15102750	3928.0	-1507.9	183.4	-1.7	1519.1	-0.9
2	40.25585934	-120.14813610	3929.1	-700.9	83.3	-2.8	705.8	0.1
3	40.25578082	-120.14719760	3928.7	-439.0	54.6	0.7	442.4	-0.3
4	40.25573657	-120.14674020	3928.8	-311.3	38.5	0.3	313.7	-0.2
5	40.25570522	-120.14644620	3928.9	-229.2	27.1	-1.0	230.8	-0.1
6	40.25569140	-120.14623530	3928.9	-170.4	22.1	1.1	171.8	-0.1
7	40.25566882	-120.14607310	3929.0	-125.1	13.8	-1.5	125.9	0.1
8	40.25566725	-120.14593960	3928.8	-87.8	13.3	2.5	88.8	-0.2
9	40.25564603	-120.14582100	3929.0	-54.7	5.5	-1.2	55.0	0.1
10	40.25561884	-120.14570730	3928.9	-23.0	-4.4	-7.1	22.3	-0.1
11 (ref)	40.25563083	-120.14562490	3929.0	0.0	0.0	0.0	0.0	0.0
12	40.25561587	-120.14549780	3928.8	35.5	-5.4	-1.1	-35.9	-0.1
13	40.25560387	-120.14538850	3928.8	66.0	-9.8	-1.7	-66.7	-0.2
14	40.25559610	-120.14528120	3928.8	95.9	-12.7	-0.9	-96.8	-0.2
15	40.25558589	-120.14513820	3928.8	135.8	-16.4	0.3	-136.8	-0.2
16	40.25556886	-120.14498790	3929.0	177.8	-22.6	-0.7	-179.2	0.0
17	40.25554852	-120.14477430	3929.0	237.4	-30.0	-0.8	-239.3	0.0
18	40.25552147	-120.14446730	3929.0	323.1	-39.8	-0.2	-325.6	0.1
19	40.25547669	-120.14400790	3929.2	451.3	-56.1	-0.7	-454.8	0.2
20	40.25538950	-120.14308150	3929.4	709.9	-87.9	-0.7	-715.3	0.4

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Table 23: *continued.*

Mic Number	Latitude	Longitude	Elipsoid Height Feet	LEN ex Feet	LEN ey Feet	x Feet	y Feet	z Feet
21	40.25511862	-120.14019130	3929.4	1516.6	-186.6	-0.3	-1528.0	0.5
22	40.26001707	-120.14848870	3928.5	-799.3	1597.9	1488.6	988.1	-0.5
23	40.25985017	-120.14644700	3928.5	-229.4	1537.1	1497.7	415.1	-0.5
24	40.25967983	-120.14494190	3928.7	190.6	1475.1	1487.3	-9.4	-0.3
25	40.25960013	-120.14348450	3929.3	597.4	1446.0	1508.1	-416.7	0.3
26	40.25939884	-120.14139350	3929.4	1181.0	1372.7	1506.4	-1004.9	0.4
27	40.25629559	-120.15273900	3928.1	-1985.6	242.3	-1.5	2000.4	-0.9
28	40.25495872	-120.13847800	3929.2	1994.8	-244.8	0.2	-2009.8	0.2
LIDAR	40.25019900	-120.14650000	3934.3	-244.3	-1978.8	-1993.8	1.3	5.3
Balloon	40.26694500	-120.15205100	3928.8	-1793.3	4121.9	3872.6	2282.3	-0.2
SWS1	40.26702500	-120.13618500	3928.8	2634.4	4151.1	4441.2	-2108.9	-0.2
SWS2	40.25495872	-120.13847800	3929.2	1994.8	-244.8	0.2	-2009.8	0.2
SWS3	40.25563083	-120.14562490	3929.0	0.0	0.0	0.0	0.0	0.0
SWS4	40.25629559	-120.15273900	3928.1	-1985.6	242.3	-1.5	2000.4	-0.9
SWS5	40.25967983	-120.14494190	3928.7	190.6	1475.1	1487.3	-9.4	-0.3
Control	40.26702500	-120.13618500	3928.8	2634.4	4151.1	4441.2	-2108.9	-0.2

Note: SWS is a ground weather station

Table 24: Salton Sea Positions.

Mic Number	Latitude	Longitude	Elipsoid Height Feet	LEN ex Feet	LEN ey Feet	x Feet	y Feet	z Feet
1	33.30114858	-115.49537090	20.2	-271.2	-1495.5	37.9	1519.5	-15.2
2	33.30333412	-115.49489150	26.7	-124.7	-700.3	15.5	711.1	-8.7
3	33.30402958	-115.49474300	30.2	-79.4	-447.2	9.6	454.1	-5.2
4	33.30439186	-115.49466510	33.9	-55.5	-315.4	6.4	320.2	-1.5
5	33.30461452	-115.49461540	34.9	-40.4	-234.4	3.8	237.8	-0.5
6	33.30478596	-115.49457810	35.4	-29.0	-172.0	2.2	174.4	0.1
7	33.30490868	-115.49455240	35.5	-21.1	-127.3	1.3	129.1	0.1
8	33.30501048	-115.49453160	36.0	-14.8	-90.3	0.7	91.5	0.6
9	33.30509807	-115.49451460	34.6	-9.6	-58.4	0.5	59.2	-0.8
10	33.30518053	-115.49450230	34.9	-5.8	-28.4	1.4	29.0	-0.5
11 (ref)	33.30525859	-115.49448330	35.4	0.0	0.0	0.0	-0.0	0.0
12	33.30533680	-115.49446430	35.5	5.8	28.5	-1.4	-29.0	0.1
13	33.30541820	-115.49444510	35.9	11.7	58.1	-2.6	-59.2	0.5
14	33.30550692	-115.49442530	36.4	17.7	90.4	-3.6	-92.0	1.0
15	33.30560852	-115.49440210	37.0	24.8	127.3	-4.9	-129.6	1.6
16	33.30573127	-115.49437410	37.9	33.4	172.0	-6.5	-175.1	2.5
17	33.30588607	-115.49433430	38.0	45.5	228.3	-9.9	-232.6	2.6
18	33.30611064	-115.49428790	39.1	59.7	310.0	-11.3	-315.5	3.8
19	33.30646818	-115.49424090	51.0	74.1	440.1	-5.5	-446.3	15.6
20	33.30715979	-115.49406330	53.4	128.3	691.8	-20.4	-703.3	18.0

Continued on next page

Table 24: *continued.*

Mic Number	Latitude	Longitude	Elipsoid Height Feet	LEN ex Feet	LEN ey Feet	x Feet	y Feet	z Feet
21	33.30927843	-115.49357900	62.3	276.3	1462.7	-48.0	-1487.8	26.9
24	33.30578943	-115.49861720	30.3	-1263.1	193.2	1277.8	3.4	-5.1
LIDAR	33.30487000	-115.49190000	43.0	789.3	-141.4	-801.7	18.3	7.7
Balloon	33.29782000	-115.50040000	57.6	-1808.0	-2706.7	1370.0	2952.6	22.2
SWS1	33.29782000	-115.50040000	57.6	-1808.0	-2706.7	1370.0	2952.6	22.2
SWS2	33.30927000	-115.49318000	62.3	398.2	1459.7	-168.9	-1503.5	26.9
SWS3	33.30511000	-115.49409000	34.6	120.2	-54.1	-127.1	34.9	-0.8
SWS4	33.30095000	-115.49496000	55.0	-145.7	-1567.8	-97.3	1571.5	19.6
SWS5	33.30580100	-115.49865700	29.5	-1275.2	197.4	1290.4	1.1	-5.9
Control	33.29782000	-115.50040000	57.6	-1808.0	-2706.7	1370.0	2952.6	22.2

Note: SWS is a ground weather station

Table 25: Flight 273 Test Card, 9/30/2014, AS350 SD1, Sweetwater, 7000 Feet.

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
900	13:32:50	13:33:50	AMB				-	1.5	225	-		Balloon Gen On
100	14:05:42	14:06:22	V1	80	0	100	48.2	2.0	145	0.966		Balloon Gen On
101	14:09:16	14:10:06	V2	72	0	100	46.7	2.7	185	0.971	90	Balloon Gen On
102	14:12:11	14:12:47	V3	105	0	100	45.2	2.0	189	0.974		M24 OD, Balloon Gen On
103	14:14:58	14:15:35	V4	96	0	100	48.7	2.4	218	0.967	85	Balloon Gen On
104	14:19:33	14:20:19	V5	80	-6	100	46.3	2.4	195	0.971		Balloon Gen Off
105	14:23:53	14:24:42	V6	73	-6	100	48.3	2.6	222	0.968		
106	14:26:45	14:27:30	V1	80	0	100	48.7	2.0	169	0.967	80	
107	14:29:48	14:30:36	V2	74	0	100	47.8	1.6	195	0.968		
108	14:32:55	14:33:32	V3	105	0	100	48.0	1.3	179	0.968		Near max speed
109	14:36:03	14:36:42	V4	97	0	100	49.0	2.4	142	0.966	79	
110	14:39:30	14:40:14	V5	80	-6	100	49.9	1.4	119	0.965		
111	14:42:59	14:43:47	V6	73	-6	100	50.7	1.7	121	0.963	75	
112	14:45:53	14:46:34	V1	80	0	100	50.9	1.9	138	0.963		
113	14:48:43	14:49:29	V2	73	0	100	49.7	2.4	136	0.969		
114	14:51:45	14:52:18	V3	105	0	100	46.9	2.7	275	0.970		
115	14:54:26	14:55:03	V4	96	0	100	49.1	1.9	141	0.966	70	
116	14:57:28	14:58:09	V5	80	-6	100	48.9	2.4	152	0.966		

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Table 25: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
117	15:00:20	15:01:08	V6	73	-6	100	49.7	2.4	150	0.965		
118	15:03:05	15:03:46	V1	80	0	100	50.6	2.2	155	0.964		
119	15:05:51	15:06:53	V2	74	0	100	48.7	2.5	149	0.968	65	
120	15:08:37	15:09:11	V3	105	0	100	47.5	2.0	159	0.969		
121	15:11:12	15:11:47	V4	97	0	100	48.1	1.8	153	0.967		
122	15:13:54	15:14:37	V5	80	-6	100	48.3	2.6	140	0.968		
123	15:16:45	15:17:29	V6	74	-6	100	49.0	2.5	135	0.966	60	
124	15:19:30	15:20:10	V1	80	0	100	48.9	1.6	164	0.966		
125	15:22:05	15:22:50	V2	74	0	100	48.8	2.1	153	0.967		
126	15:24:46	15:25:20	V3	105	0	100	49.7	2.2	137	0.965		
127	15:27:12	15:27:48	V4	97	0	100	50.9	1.6	128	0.963		
128	15:30:05	15:30:46	V5	80	-6	100	48.4	1.6	163	0.968	55	
129	15:32:53	15:33:37	V6	74	-6	100	48.3	1.4	164	0.967		Truck on road
130	15:35:39	15:36:22	V1	80	0	100	50.6	2.0	179	0.964		Truck on road
131	15:38:20	15:39:06	V2	74	0	100	50.1	2.0	186	0.965		Truck departed
132	15:40:52	15:41:24	V3	105	0	100	49.7	1.5	175	0.965	50	
133	15:43:15	15:43:49	V4	97	0	100	50.1	1.5	165	0.965		
134	15:45:53	15:46:37	V5	80	-6	100	50.8	1.6	166	0.963		
135	15:48:41	15:49:28	V6	73	-6	100	52.9	0.2	207	0.964	49	

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Table 25: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	WS Kts	WD °	Dens kg/m^3	Fuel %	Comments
												Refuel
901	15:53:56	15:54:56	AMB				51.6	0.0	255	0.962		Balloon GenOff
902	15:55:55	15:56:55	AMB				51.6	0.0	255	0.961		Balloon Gen On, Truck On Highway
136	16:36:07	16:36:46	V1	80	0	100	53.5	2.2	128	0.959		Balloon Gen Off
137	16:38:40	16:39:26	V2	73	0	100	53.3	1.4	71	0.955	92	
138	16:41:19	16:41:52	V3	105	0	100	53.4	2.0	138	0.957		
139	16:43:42	16:44:19	V4	96	0	100	54.0	1.4	140	0.954		
140	16:46:24	16:47:09	V5	80	-6	100	55.0	1.4	113	0.957		Prop Plane OH
141	16:49:14	16:50:04	V6	73	-6	100	54.1	1.3	118	0.957		
142	16:52:01	16:52:45	V1	80	0	100	54.6	1.1	25	0.954		
143	16:54:51	16:55:40	V2	73	0	100	55.0	1.4	73	0.955	87	Jet OH
144	16:57:37	16:58:11	V3	105	0	100	54.6	1.1	49	0.957		
145	17:00:03	17:00:40	V4	96	0	100	54.4	2.0	10	0.958		
146	17:02:43	17:03:28	V5	80	-6	100	53.3	3.0	1	0.959		
147	17:05:35	17:06:25	V6	73	-6	100	54.0	3.7	2	0.958	80	
148	17:08:24	17:09:09	V1	80	0	100	53.5	3.2	21	0.957		
149	17:11:20	17:12:08	V2	73	0	100	53.7	3.3	7	0.956		
150	17:14:08	17:14:44	V3	105	0	100	53.7	2.7	5	0.957		

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Table 25: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
151	17:16:35	17:17:13	V4	96	0	100	53.8	2.7	26	0.957	78	
152	17:19:21	17:20:06	V5	80	-6	100	54.1	3.2	15	0.959		
153	17:22:09	17:22:57	V6	73	-6	100	54.8	3.3	1	0.956		
154	17:24:49	17:25:33	V1	80	0	100	53.8	2.3	42	0.957		
155	17:27:35	17:28:27	V2	73	0	100	54.5	2.2	46	0.954		
156	17:30:18	17:30:53	V3	105	0	100	54.6	3.2	333	0.957	70	
157	17:32:41	17:33:20	V4	96	0	100	54.6	2.4	3	0.957		
158	17:35:20	17:36:06	V5	80	-6	100	54.2	2.6	6	0.956		
159	17:38:04	17:38:51	V6	73	-6	100	55.0	3.6	6	0.955		
160	17:40:42	17:41:27	V1	80	0	100	55.0	2.7	25	0.955	68	
161	17:43:33	17:44:21	V2	73	0	100	54.4	2.6	32	0.956		
162	17:46:11	17:46:46	V3	105	0	100	54.5	3.2	339	0.956		
163	17:48:43	17:49:14	V4	96	0	100	54.3	2.9	22	0.957		
164	17:51:10	17:51:55	V5	80	-6	100	54.7	3.7	13	0.957		
165	17:55:25	17:56:14	V6	73	-6	100	54.9	2.9	7	0.956		Low Altitude
166	17:58:18	17:59:04	V6	73	-6	100	54.5	2.9	356	0.957	60	High Altitude
903	18:01:59	18:02:59	AMB				55.2	3.0	21	0.955		

Times are UTC (LOCAL: 0643, UTC 1343)

Table 26: Flight 274 Test Card, 10/1/2014, AS350 SD1, Sweetwater, 7000 Feet.

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA	N_R	Balloon				Fuel	Comments
					°	%	T °F	WS Kts	WD °	Dens kg/m^3	%	
905	13:47:03	13:48:03	AMB				39.4	3.2	344	0.987		Coyote Howling
167	14:05:48	14:06:33	V1	80	0	100	39	3.2	345	0.988	50	Campers near M27
168	14:08:40	14:09:28	V2	74	0	100	38.9	3.2	348	0.988		
169	14:11:23	14:11:58	V3	105	0	100	38.9	2.7	352	0.989		
170	14:13:53	14:14:32	V4	97	0	100	38.2	2.6	345	0.989		
171	14:16:39	14:17:28	V5	80	-6	100	38.6	3.2	341	0.989		
172	14:19:30	14:20:19	V6	74	-6	100	39	3.3	350	0.988	42	
173	14:22:14	14:22:59	V1	80	0	100	39.6	3	342	0.987		
174	14:25:06	14:25:54	V2	73	0	100	39.3	3.4	341	0.988		
175	14:27:48	14:28:22	V3	105	0	100	39.2	2.6	352	0.987		
176	14:30:21	14:30:58	V4	96	0	100	39.5	3	338	0.987		
177	14:32:54	14:33:41	V5	80	-6	100	39.3	2.5	339	0.987		
178	14:35:42	14:36:30	V6	73	-6	100	39.3	2.7	353	0.987	39	
179	14:38:34	14:39:16	V1	80	0	100	39.3	2.6	355	0.987		
180	14:41:24	14:42:11	V2	73	0	100	39.4	3.1	356	0.987		
181	14:44:12	14:44:45	V3	105	0	100	39.3	2.9	357	0.987		
182	14:46:46	14:47:20	V4	96	0	100	39.4	2.6	353	0.987		
183	14:49:27	14:50:13	V5	80	-6	100	39.1	2.4	358	0.987		
184	14:52:22	14:53:13	V6	73	-6	100	39.4	2.4	347	0.986	30	

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Table 26: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
185	14:55:19	14:56:02	V1	80	0	100	39.6	1.6	350	0.986		
186	14:58:09	14:58:55	V2	73	0	100	39.7	1.9	350	0.986		
187	15:00:48	15:01:22	V3	105	0	100	39.8	1.9	350	0.986		
188	15:03:16	15:03:53	V4	96	0	100	39.7	1.7	0	0.986		
189	15:05:52	15:06:38	V5	80	-6	100	39.6	1.9	1	0.986	20	
190	15:08:41	15:09:26	V6	73	-6	100	39.7	1.6	2	0.986		
191	15:11:30	15:12:12	V1	80	0	100	39.7	1.6	355	0.986		
192	15:14:26	15:15:14	V2	73	0	100	39.7	1.9	359	0.986	20	
												Refuel
906	15:31:01	15:32:01	AMB				40.2	3.3	15	0.986		
193	15:57:29	15:58:04	V3	105	0	100	40.5	2.8	355	0.986	50	
194	15:59:48	16:00:25	V4	96	0	100	41.4	2.1	353	0.983		
195	16:02:25	16:03:13	V5	80	-6	100	41	1.9	353	0.984		M1, M21 OD
196	16:05:21	16:06:14	V6	73	-6	100	40.9	2.2	4	0.984		
197	16:08:11	16:08:56	V1	80	0	100	41	2.6	6	0.984	41	
198	16:10:52	16:11:43	V2	73	0	100	41	2.3	0	0.984		
199	16:13:34	16:14:09	V3	105	0	100	41.5	2.6	356	0.984		
200	16:15:53	16:16:32	V4	96	0	100	41.2	2.2	349	0.984		
201	16:18:31	16:19:18	V5	80	-6	100	41.8	2.7	355	0.984	40	

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Table 26: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	WS Kts	WD °	Dens kg/m^3	Fuel %	Comments
202	16:21:14	16:22:04	V6	73	-6	100	42	2.9	10	0.983		
203	16:24:03	16:24:46	V1	80	0	100	41.1	2.6	344	0.984		Jet pressent
204	16:26:54	16:27:44	V2	73	0	100	41.9	2.9	18	0.983		
205	16:29:36	16:30:09	V3	105	0	100	42.2	3.2	352	0.982		
206	16:31:59	16:32:37	V4	96	0	100	41.6	2.6	6	0.984	32	
207	16:34:37	16:35:19	V5	80	-6	100	42.4	3.1	11	0.983		
208	16:37:22	16:38:13	V6	73	-6	100	41.4	2.6	19	0.984		
209	16:40:08	16:40:52	V1	80	0	100	42.3	2.4	295	0.981		
210	16:42:50	16:43:37	V2	73	0	100	42.3	2.1	15	0.984		Prop Plane
211	16:45:29	16:46:04	V3	105	0	100	42.2	2.9	351	0.983		
212	16:47:54	16:48:31	V4	96	0	100	41.8	2.9	8	0.984	25	
213	16:50:27	16:51:12	V5	80	-6	100	42.4	2	35	0.983		
214	16:53:12	16:54:03	V6	73	-6	100	42.5	1.6	5	0.983		
215	16:56:03	16:56:46	V1	80	0	100	42.3	1.9	2	0.979		
216	16:58:51	16:59:38	V2	73	0	100	41.8	3.5	12	0.984	22	
217	17:01:37	17:02:10	V3	105	0	100	41.9	3.5	22	0.983		
218	17:04:03	17:04:39	V4	96	0	100	41.3	2.2	38	0.984		
219	17:06:46	17:07:31	V5	80	-6	100	44.3	0.6	41	0.995		Odd temp swing
220	17:09:46	17:10:35	V6	73	-6	100	43	1.7	22	0.982	20	Jet Overhead

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Table 26: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA	N_R	Balloon				Fuel	Comments
							T	WS	WD	Dens		
					°	%	°F	Kts	°	kg/m^3	%	
221	17:12:38	17:13:21	V1	80	0	100	42.8	3.3	14	0.982		
222	17:15:20	17:16:07	V2	73	0	100	42.9	1.6	25	0.98		
223	17:18:04	17:18:38	V3	105	0	100	42.7	1.9	13	0.981		
224	17:20:35	17:21:10	V4	96	0	100	43.1	1.6	10	0.979	17	
907	17:25:03	17:26:03	AMB				44.2	1.9	69	0.976		

Times are UTC (LOCAL: 0643, UTC 1343)

Table 27: Flight 275 Test Card, 10/2/2014, AS350 SD1, Sweetwater, 7000 Feet.

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
908	13:41:25	13:42:24	AMB				36.7	0	326	0.999		
225	14:07:53	14:08:49	L1	60	0	100	40.9	0	138	0.99	50	
226	14:10:53	14:11:40	L2	70	0	100	39.8	0	3	0.991		Jet
227	14:13:42	14:14:17	L3	90	0	100	41.8	0	54	0.987		
228	14:16:17	14:16:52	L4	100	0	100	43.3	0	131	0.986		
229	14:18:52	14:19:23	L5	Vh	0	100	40.1	0	71	0.99	41	110 KIAS
230	14:21:27	14:22:07	V1	80	0	100	40.4	0	69	0.991		
231	14:24:14	14:24:57	V2	74	0	100	43.3	0	122	0.985		
232	14:26:50	14:27:23	V3	105	0	100	42.7	0	126	0.986		
233	14:29:23	14:29:58	V4	97	0	100	41.4	0	100	0.989		
234	14:32:03	14:32:45	V5	80	-6	100	41.3	0	113	0.99		
235	14:34:44	14:35:29	V6	74	-6	100	36	6	116	1	39	Wind spike
236	14:37:36	14:38:30	V1	80	0	100	33	0	126	1.006		Skycrane to East
237	14:40:19	14:41:03	V2	73	0	100	24.5	0	128	1.024		Low temp spike
238	14:43:01	14:43:33	V3	105	0	100	41.5	0	159	0.99		
239	14:45:33	14:46:09	V4	96	0	100	41.9	0	148	0.989		
240	14:48:20	14:49:02	V5	80	-6	100	42.1	0	147	0.988	31	
241	14:51:08	14:51:53	V6	73	-6	100	42.1	0	140	0.988		Jet
242	14:54:05	14:54:39	V1	80	0	100	42.6	1.5	134	0.988		

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Table 27: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA	N_R	Balloon				Fuel	Comments
							T	WS	WD	Dens		
					°	%	°F	Kts	°	kg/m^3	%	
243	14:56:34	14:57:18	V2	74	0	100	42.1	1.4	137	0.987		
244	14:59:09	14:59:40	V3	105	0	100	42.9	1.6	133	0.985		Jet
245	15:01:31	15:02:05	V4	96	0	100	42.1	1.5	150	0.985	28	
246	15:04:02	15:04:43	V5	80	-6	100	43.1	1.3	151	0.985		
247	15:06:37	15:07:21	V6	73	-6	100	42.8	1.4	172	0.986		
248	15:09:18	15:09:55	V1	80	0	100	42.6	1.1	162	0.986		
249	15:11:55	15:12:39	V2	73	0	100	43.3	1.5	156	0.985		
250	15:14:36	15:15:06	V3	105	0	100	42.3	1.9	155	0.987		
251	15:17:03	15:17:34	V4	96	0	100	42.5	1.8	145	0.986		
252	15:19:32	15:20:10	V5	80	-6	100	44	2.4	139	0.983	20	
253	15:22:15	15:22:58	V6	73	-6	100	43	1.7	156	0.985		
254	15:24:59	15:25:41	V1	80	0	100	43.1	2.2	155	0.986		
255	15:27:42	15:28:22	V2	73	0	100	43.9	2.3	149	0.985		
256	15:30:19	15:30:49	V3	105	0	100	43.3	2.2	132	0.984	18	
909	15:43:25	15:44:25	AMB				43.1	3.2	148	0.987		
												Refuel
910	16:03:55	16:04:55	AMB				43.8	5.5	153	0.986		
257	16:28:22	16:29:08	L1	60	0	100	45.8	4.5	151	0.982	98	
258	16:31:24	16:32:06	L2	70	0	100	46.2	4.5	154	0.984		

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Table 27: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
259	16:35:29	16:36:05	L3	90	0	100	46.1	4.4	159	0.982		
260	16:38:11	16:38:41	L4	100	0	100	45.5	4.3	168	0.982		
261	16:40:50	16:41:17	L5	Vh	0	100	46.2	4.4	150	0.982	89	108 KIAS
262	16:43:21	16:44:00	V1	80	0	100	46.3	4.4	173	0.981		
263	16:47:11	16:47:54	V2	73	0	100	46.9	4.3	161	0.98		Problems lining up
264	16:49:51	16:50:22	V3	105	0	100	47.2	3.6	162	0.979		
265	16:52:18	16:52:52	V4	97	0	100	47.1	3.6	169	0.979	81	
911	17:01:07	17:02:06	AMB				49.4	3.6	151	0.976		

Times are UTC (LOCAL: 0643, UTC 1343)

Table 28: Flight 301 Test Card, 10/28/2014, AS350 SD1, Amedee, 4000 Feet.

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
900	12:55:48	12:56:48	AMB									
901	14:00:01	14:01:01	AMB				32.3	0.0	57	1.115		
100	14:39:08	14:39:52	V1	80	0	100	36.1	0.0	208	1.106	70	
101	14:41:35	14:42:21	V2	71	0	100	35.6	0.0	200	1.108		
102	14:44:13	14:44:44	V3	105	0	100	35.5	0.0	309	1.108		
103	14:46:26	14:47:01	V4	96	0	100	34.8	0.0	340	1.109		
104	14:49:00	14:49:46	V5	80	-6	100	35.0	0.0	3	1.109		
105	14:51:58	14:52:47	V6	71	-6	100	35.5	0.0	23	1.107	65	
106	14:54:34	14:55:15	V1	80	0	100	35.4	0.0	21	1.108		
107	14:57:00	14:57:46	V2	71	0	100	36.0	0.0	7	1.107		
108	14:59:29	15:00:01	V3	105	0	100	35.5	0.0	5	1.108		
109	15:01:40	15:02:15	V4	96	0	100	35.6	0.0	357	1.108		
110	15:03:59	15:04:42	V5	80	-6	100	35.7	0.0	257	1.107		
111	15:06:29	15:07:18	V6	71	-6	100	35.9	0.0	1	1.107	60	
112	15:09:02	15:09:41	V1	80	0	100	36.7	0.0	355	1.105		
113	15:11:25	15:12:08	V2	73	0	100	36.2	0.0	307	1.107		
114	15:14:04	15:14:37	V3	105	0	100	35.6	0.0	305	1.108		
115	15:16:37	15:17:12	V4	96	0	100	35.9	0.0	298	1.108		
116	15:19:06	15:19:47	V5	80	-6	100	35.9	0.0	307	1.107		

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Table 28: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	WS Kts	WD °	Dens kg/m^3	Fuel %	Comments
117	15:21:55	15:22:38	V6	71	-6	100	35.5	0.0	302	1.108	55	
118	15:24:37	15:25:20	V1	80	0	100	35.5	1.6	301	1.109		
119	15:27:23	15:28:10	V2	71	0	100	35.7	1.3	312	1.108		
120	15:30:10	15:30:43	V3	105	0	100	35.5	1.3	322	1.109		
121	15:32:52	15:33:27	V4	96	0	100	35.6	1.3	327	1.108		
122	15:35:11	15:35:53	V5	80	-6	100	35.8	1.3	335	1.108		
123	15:39:38	15:40:28	V6	71	-6	100	36.5	0.8	345	1.106	46	
124	15:42:27	15:43:08	V1	80	0	100	37.5	0.0	350	1.104		
125	15:45:13	15:46:00	V2	73	0	100	38.5	0.0	317	1.100		
126	15:48:04	15:48:42	V3	105	0	100	37.6	0.0	305	1.103		
127	15:50:37	15:51:13	V4	97	0	100	37.5	0.0	296	1.106		
128	15:53:07	15:53:49	V5	80	-6	100	37.8	0.0	259	1.104		
129	15:55:35	15:56:21	V6	73	-6	100	37.2	0.0	262	1.105	40	
130	15:58:09	15:58:50	V1	80	0	100	36.5	0.0	269	1.107		
131	16:00:44	16:01:30	V2	73	0	100	36.5	0.0	265	1.107		
132	16:03:37	16:04:12	V3	105	0	100	36.0	0.0	258	1.108		
133	16:06:10	16:06:44	V4	97	0	100	36.6	0.0	253	1.107		
134	16:08:28	16:09:09	V5	80	-6	100	36.8	0.0	252	1.106		
135	16:11:06	16:11:52	V6	73	-6	100	37.4	0.0	211	1.105	32	

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Table 28: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
136	16:13:50	16:14:31	V1	80	0	100	37.4	0.0	222	1.105		
137	16:16:27	16:17:12	V2	73	0	100	37.1	0.0	210	1.105		
138	16:19:33	16:20:02	V3	105	0	100	39.7	0.0	198	1.103		
139	16:22:11	16:22:46	V4	100	0	100	38.9	0.0	282	1.098		
140	16:24:42	16:25:26	V5	80	-6	100	41.6	0.0	126	1.101		
141	16:27:16	16:28:03	V6	76	-6	100	38.5	0.0	30	1.101	28	
902	16:33:20	16:34:20	AMB				40.4	0.0	41	1.090		
												Refuel, 70 G added
142	17:09:05	17:09:48	V1	80	0	100	46.9	0.0	55	1.084	70	
143	17:11:43	17:12:23	V2	79	0	100	44.2	0.0	353	-		Balloon Wx bad
												Trailer Wx used
144	17:14:31	17:15:05	V3	105	0	100	44.4	0.0	304	-		Trailer Wx
												Replacing sonde
145	17:16:57	17:17:30	V4	104	0	100	44.2	1.5	-	-		Trailer Wx
146	17:19:22	17:20:05	V5	80	-6	100	43.8	1.0	-	-		Trailer Wx
147	17:21:41	17:22:30	V6	79	-6	100	44.3	0.0	-	-	61	Trailer Wx
148	17:25:04	17:26:00	L1	60	0	100	44.4	1.7	-	-		Trailer Wx
												Truck Backup Alarm
149	17:27:56	17:28:42	L2	70	0	100	44.4	1.5	-	-		Trailer Wx

Continued on next page

Table 28: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	WS Kts	WD °	Dens kg/m^3	Fuel %	Comments
150	17:30:27	17:31:05	L3	90	0	100	44.7	1.2	-	-		Trailer Wx
151	17:32:55	17:33:28	L4	100	0	100	45.0	0.7	-	-		Trailer Wx
152	17:35:26	17:35:58	L5	Vh	0	100	45.1	2.2	-	-	59	M21 OD Trailer Wx Vh = 110 kts
												Replaced balloon sonde
153	17:49:43	17:50:24	V1	80	0	100	42.3	6.1	272	1.095	57	
154	17:52:02	17:52:46	V2	76	0	100	42.6	5.7	259	1.095		
155	17:54:48	17:55:21	V3	105	0	100	44.1	1.8	278	1.090		
156	17:57:31	17:58:03	V4	102	0	100	44.9	1.4	291	1.086		
157	17:59:52	18:00:35	V5	80	-6	100	49.8	0.9	311	1.077		M1 OD
158	18:02:22	18:03:07	V6	78	-6	100	46.6	0.7	338	1.083		
159	18:04:54	18:05:35	V1	80	0	100	43.9	2.5	260	1.089	48	
160	18:07:21	18:08:05	V2	78	0	100	43.4	3.9	281	1.090		Winds gusting
161	18:10:09	18:10:41	V3	105	0	100	44.9	2.1	257	1.087		
162	18:12:24	18:12:55	V4	102	0	100	44.8	4.1	245	1.088		
163	18:14:32	18:15:16	V5	80	-6	100	44.9	2.2	259	1.087		
164	18:16:55	18:17:43	V6	78	-6	100	45.1	4.3	275	1.088	41	
165	18:19:31	18:20:11	V1	80	0	100	45.4	2.5	316	1.085		

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Table 28: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	WS Kts	WD °	Dens kg/m^3	Fuel %	Comments
166	18:21:55	18:22:35	V2	77	0	100	47.7	3.2	281	1.081		
167	18:24:32	18:25:04	V3	105	0	100	45.3	3.0	294	1.087		
168	18:26:51	18:27:23	V4	101	0	100	45.8	2.8	358	1.085		
169	18:28:58	18:29:42	V5	80	-6	100	47.7	0.9	357	1.083	39	
170	18:31:36	18:32:22	V6	77	-6	100	47.1	1.9	312	1.084		Run at wrong alt
171	18:34:14	18:34:55	V1	80	0	100	47.8	1.9	270	1.082		
172	18:36:34	18:37:16	V2	80	0	100	47.6	2.5	243	1.082		
173	18:39:21	18:39:52	V3	105	0	100	48.2	2.0	268	1.081		
174	18:41:42	18:42:15	V4	102	0	100	47.4	3.3	226	1.080		
175	18:44:04	18:44:49	V5	80	-6	100	47.5	3.1	267	1.081		
176	18:46:32	18:47:14	V6	78	-6	100	47.2	3.1	262	1.082	30	
177	18:49:02	18:49:41	V1	80	0	100	51.7	2.1	200	1.076		
178	18:51:44	18:52:23	V2	81	0	100	50.6	2.2	211	1.078		
179	18:54:27	18:54:58	V3	105	0	100	47.4	3.0	281	1.083		
180	18:57:01	18:57:33	V4	102	0	100	50.6	1.4	237	1.077		
181	18:59:19	19:00:01	V5	80	-6	100	48.7	2.2	273	1.081		
182	19:01:32	19:02:12	V6	78	-6	100	47.7	4.2	268	1.083	22	
903	19:07:59	19:08:59	AMB				54.1	1.2	207	1.072		

Times are UTC (LOCAL: 0604, UTC 1304)

Table 29: Flight 302 Test Card, 10/29/2014, AS350 SD1, Amedee, 4000 Feet.

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
904	13:34:33	13:35:33	AMB				45.9	1.6	226	1.085		
200	14:33:41	14:34:22	V1	80	0	100	41.2	1.3	89	1.095	100	
201	14:36:09	14:36:53	V2	75	0	100	42.4	2.4	106	1.092		
202	14:38:46	14:39:15	V3	105	0	100	42.9	3.4	125	1.091		
203	14:41:11	14:41:45	V4	100	0	100	41.9	3.3	134	1.094		
204	14:43:39	14:44:23	V5	80	-6	100	40.0	3.9	139	1.098		
205	14:46:11	14:46:55	V6	75	-6	100	39.2	3.7	130	1.100		
206	14:48:43	14:49:23	V1	80	0	100	39.1	2.9	135	1.100	96	
207	14:51:09	14:51:50	V2	75	0	100	39.2	3.2	130	1.100		
208	14:53:42	14:54:13	V3	105	0	100	39.1	3.9	138	1.100		
209	14:55:59	14:56:34	V4	99	0	100	40.5	3.2	110	1.096		
210	14:58:14	14:58:56	V5	80	-6	100	39.6	3.2	127	1.099		
211	15:00:47	15:01:29	V6	75	-6	100	39.0	3.4	116	1.100	89	
212	15:03:18	15:03:59	V1	80	0	100	38.6	4.0	116	1.101		
213	15:05:40	15:06:25	V2	73	0	100	38.7	4.9	106	1.101		
214	15:08:10	15:08:42	V3	105	0	100	40.1	4.5	99	1.098		
215	15:10:27	15:11:00	V4	99	0	100	41.0	4.0	95	1.095		
216	15:12:43	15:13:27	V5	80	-6	100	40.4	4.5	99	1.097	80	UH-60 in airspace Testing paused

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Table 29: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
217	16:18:32	16:19:17	V6	80	-6	100	50.3	1.8	151	1.078		
218	16:21:01	16:21:43	V1	80	0	100	49.0	1.4	141	1.080		
219	16:23:22	16:24:03	V2	80	0	100	46.3	2.2	111	1.086		
220	16:26:05	16:26:40	V3	105	0	100	48.6	3.6	118	1.080		
221	16:28:32	16:29:06	V4	102	0	100	48.4	3.0	105	1.081		Helo in area
222	16:30:51	16:31:34	V5	80	-6	100	48.4	2.7	98	1.081		Helo in area
223	16:33:34	16:34:19	V6	78	-6	100	49.0	2.4	140	1.080	71	Helo in area
224	16:37:47	16:38:29	V1	80	0	100	48.7	2.2	123	1.080		
225	16:40:33	16:41:17	V2	78	0	100	48.1	1.9	137	1.082		
226	16:43:22	16:43:57	V3	105	0	100	47.6	1.4	153	1.082		
227	16:45:50	16:46:24	V4	102	0	100	52.0	1.6	149	1.072		
228	16:48:09	16:48:51	V5	80	-6	100	53.7	1.4	139	1.071		
229	16:50:43	16:51:23	V6	82	-6	100	49.0	1.6	120	1.080	64	
230	16:53:19	16:54:01	V1	80	0	100	49.2	1.9	206	1.080		
231	16:56:04	16:56:44	V2	82	0	100	51.0	1.6	187	1.075		
232	16:58:42	16:59:14	V3	105	0	100	52.6	2.2	182	1.071		
233	17:01:16	17:01:49	V4	105	0	100	51.8	2.2	195	1.075		
234	17:03:32	17:04:12	V5	80	-6	100	50.6	2.6	204	1.077		
235	17:06:03	17:06:43	V6	80	-6	100	51.5	3.2	202	1.074	59	

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Table 29: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	WS Kts	WD °	Dens kg/m^3	Fuel %	Comments
236	17:08:47	17:09:25	V1	80	0	100	51.4	2.4	242	1.075		
237	17:11:28	17:12:09	V2	82	0	100	52.0	2.7	187	1.074		
238	17:14:03	17:14:34	V3	105	0	100	53.6	3.3	179	1.070		
239	17:16:36	17:17:08	V4	105	0	100	52.8	2.5	177	1.073		
240	17:18:58	17:19:40	V5	80	-6	100	50.9	3.6	172	1.076		
241	17:21:32	17:22:15	V6	80	-6	100	50.5	2.0	116	1.077	53	
242	17:24:10	17:24:49	V1	80	0	100	50.7	2.3	177	1.074		
243	17:26:49	17:27:29	V2	80	0	100	50.4	2.4	174	1.077		
244	17:29:36	17:30:10	V3	105	0	100	50.5	2.5	176	1.076		
245	17:32:17	17:32:50	V4	104	0	100	50.5	1.7	180	1.076		
246	17:34:45	17:35:25	V5	80	-6	100	50.9	1.6	136	1.075		
247	17:37:21	17:38:06	V6	80	-6	100	52.0	1.0	181	1.074	46	
905	17:43:11	17:44:10	AMB				53.2	1.6	253	1.070		
												Refuel, added 80 G
248	18:08:44	18:09:24	V1	80	0	100	59.8	1.1	150	1.055	100	
249	18:11:25	18:12:04	V2	84	0	100	59.6	2.4	183	1.059		
250	18:13:58	18:14:31	V3	105	0	100	59.1	1.6	171	1.053		
251	18:16:30	18:17:02	V4	107	0	100	56.2	4.9	191	1.063		
252	18:18:45	18:19:30	V5	80	-6	100	55.7	4.0	175	1.066		

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Table 29: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
253	18:21:29	18:22:09	V6	85	-6	100	56.7	3.8	195	1.062	94	
254	18:24:06	18:24:43	V1	80	0	100	56.7	4.1	194	1.064		
255	18:26:44	18:27:23	V2	85	0	100	57.0	4.3	165	1.063		
256	18:29:38	18:30:12	V3	105	0	100	57.4	2.7	230	1.063		
257	18:32:21	18:32:55	V4	107	0	100	58.1	3.3	159	1.063		
258	18:34:50	18:35:34	V5	80	-6	100	58.0	3.5	186	1.061		
259	18:37:31	18:38:13	V6	85	-6	100	58.2	5.2	190	1.063	85	
260	18:39:57	18:40:37	V5	80	-6	100	57.5	5.7	149	1.062		
261	18:42:40	18:43:20	V1	80	0	100	59.7	4.6	215	1.062		C130s 15mi out
262	18:45:37	18:46:17	V2	85	0	100	61.3	2.7	206	1.054		
263	18:48:25	18:48:58	V3	105	0	100	59.8	4.3	178	1.056		
264	18:51:03	18:51:35	V4	109	0	100	62.3	2.1	198	1.052		
265	18:53:26	18:54:09	V5	80	-6	100	57.5	3.8	149	1.062		
266	18:55:57	18:56:38	V6	87	-6	100	60.7	4.7	160	1.055	79	
267	18:58:45	18:59:25	V1	80	0	100	58.5	3.8	155	1.060		
268	19:01:18	19:01:56	V2	85	0	100	58.9	5.7	148	1.059		Possible UH-60
269	19:04:06	19:04:34	V3	105	0	100	59.2	2.9	155	1.058		Possible UH-60
270	19:06:25	19:06:59	V4	109	0	100	61.1	3.2	220	1.054		Possible UH-60
271	19:08:47	19:09:31	V5	80	-6	100	62.6	1.4	227	1.051		Possible UH-60

Continued on next page

Table 29: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
272	19:11:26	19:12:05	V6	87	-6	100	59.4	1.0	154	1.055	70	Possible UH-60
273	19:14:08	19:14:50	V1	80	0	100	62.2	1.6	262	1.051		Possible UH-60
274	19:17:01	19:17:41	V2	85	0	100	60.3	2.2	302	1.056		Possible UH-60
275	19:19:33	19:20:05	V3	105	0	100	59.8	1.9	291	1.057		M27 OD Possible UH-60
276	19:21:55	19:22:27	V4	109	0	100	59.4	4.4	328	1.058		Possible Blackhawk
277	19:24:20	19:25:03	V5	80	-6	100	57.2	8.2	284	1.063		Balloon and LIDAR meas. inconsistent
278	19:26:57	19:27:44	V6	84	-6	100	56.2	10.0	287	1.066	61	
279	19:30:45	19:31:30	V1	80	0	100	57.4	8.9	281	1.062		M27 OD
280	19:33:33	19:34:14	V2	84	0	100	58.0	3.1	285	1.060		
281	19:36:03	19:36:36	V3	105	0	100	57.1	6.5	265	1.062		
282	19:38:33	19:39:08	V4	107	0	100	57.9	5.1	257	1.061		
283	19:40:46	19:41:32	V5	80	-6	100	58.0	3.6	272	1.060		
284	19:43:04	19:43:44	V6	84	-6	100	58.1	7.2	283	1.060	57	
285	19:45:34	19:46:16	V1	80	0	100	58.7	3.6	269	1.058		
286	19:48:22	19:49:02	V2	85	0	100	59.4	2.9	276	1.057		
287	19:50:52	19:51:28	V3	105	0	100	61.4	1.4	27	1.051		
288	19:53:24	19:53:58	V4	110	0	100	60.1	2.9	256	1.055		

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Table 29: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
289	19:55:56	19:56:35	V5	80	-6	100	59.3	5.7	284	1.057		
290	19:58:21	19:59:03	V6	84	-6	100	58.7	4.2	280	1.058	50	
291	20:00:54	20:01:34	V1	80	0	100	60.0	3.2	247	1.055		
292	20:03:32	20:04:10	V2	85	0	100	60.5	2.9	271	1.055		
293	20:06:03	20:06:36	V3	105	0	100	60.1	2.6	297	1.056		
294	20:08:31	20:09:06	V4	109	0	100	61.2	2.5	323	1.053		
295	20:10:57	20:11:40	V5	80	-6	100	62.6	3.0	125	1.050		
296	20:13:37	20:14:18	V6	87	-6	100	65.9	1.8	323	1.048	44	
906	20:19:40	20:20:40	AMB				62.3	0.9	116	1.050		

Times are UTC (LOCAL: 0604, UTC 1304)

Table 30: Flight 303 Test Card, 10/30/2014, AS350 SD1, Amedee, 4000 Feet.

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
907	14:06:53	14:07:53	AMB				44.6	0.6	282	1.083		
300	14:39:57	14:40:37	V1	80	0	100	45.5	4.2	74	1.081	100	
301	14:42:24	14:43:09	V2	77	0	100	46.1	3.7	66	1.080		
302	14:45:02	14:45:38	V3	105	0	100	47.1	3.2	64	1.077		
303	14:47:28	14:48:02	V4	102	0	100	46.3	3.3	79	1.080		
304	14:49:36	14:50:19	V5	80	-6	100	45.1	3.1	94	1.082		
305	14:52:03	14:52:46	V6	77	-6	100	45.1	3.2	108	1.082	93	
306	14:54:40	14:55:21	V1	80	0	100	45.3	3.1	128	1.082		
307	14:57:20	14:58:04	V2	77	0	100	45.1	3.0	135	1.082		
308	14:59:55	15:00:26	V3	105	0	100	44.7	3.2	145	1.083		
309	15:02:11	15:02:43	V4	101	0	100	43.7	2.9	143	1.085		
310	15:04:25	15:05:09	V5	80	-6	100	43.6	2.4	145	1.086		
311	15:06:54	15:07:41	V6	75	-6	100	41.9	0.8	162	1.088	88	
312	15:09:32	15:10:13	V1	80	0	100	41.4	1.8	305	1.092		
313	15:12:03	15:12:48	V2	74	0	100	40.8	1.4	293	1.092		
314	15:14:35	15:15:08	V3	105	0	100	40.7	1.7	293	1.092		
315	15:16:48	15:17:21	V4	98	0	100	40.8	1.1	298	1.092		
316	15:19:06	15:19:49	V5	80	-6	100	40.9	1.1	306	1.092		
317	15:21:31	15:22:15	V6	74	-6	100	43.2	1.0	53	1.086	80	

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Table 30: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	WS Kts	WD °	Dens kg/m^3	Fuel %	Comments
318	15:24:16	15:24:59	V1	80	0	100	44.0	0.9	49	1.085		
319	15:26:47	15:27:31	V2	77	0	100	43.2	1.5	24	1.086		
320	15:29:36	15:30:09	V3	105	0	100	42.6	2.1	49	1.087		
321	15:31:53	15:32:28	V4	99	0	100	42.3	2.6	49	1.089		
322	15:34:10	15:34:55	V5	80	-6	100	43.1	2.0	98	1.087		
323	15:36:41	15:37:29	V6	77	-6	100	43.8	2.4	85	1.085	73	
324	15:39:17	15:40:00	V1	80	0	100	44.2	2.7	78	1.084		
325	15:41:53	15:42:40	V2	77	0	100	44.7	2.9	76	1.085		
326	15:44:32	15:45:07	V3	105	0	100	44.2	3.0	88	1.084		
327	15:46:44	15:47:19	V4	101	0	100	44.3	3.7	88	1.084		
328	15:49:03	15:49:47	V5	80	-6	100	44.5	4.3	80	1.084	69	
329	15:51:37	15:52:24	V6	77	-6	100	46.3	4.2	84	1.080		
330	15:54:24	15:55:08	V1	80	0	100	44.8	4.0	93	1.084		
331	15:56:49	15:57:33	V2	77	0	100	43.8	3.7	108	1.086		
332	15:59:38	16:00:18	V3	105	0	100	46.0	4.2	93	1.080		
333	16:02:04	16:02:37	V4	101	0	100	44.6	3.4	105	1.083		
334	16:06:07	16:06:52	V5	80	-6	100	43.1	1.3	201	1.086		
335	16:08:38	16:09:26	V6	77	-6	100	43.2	1.5	192	1.086	60	
336	16:11:26	16:12:12	V1	80	0	100	43.0	0.9	224	1.087		

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Table 30: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
337	16:14:06	16:14:49	V2	75	0	100	44.4	0.3	244	1.083		
338	16:16:49	16:17:24	V3	105	0	100	43.7	0.6	259	1.085		
339	16:19:08	16:19:41	V4	101	0	100	43.3	1.2	321	1.087		
340	16:21:32	16:22:14	V5	80	-6	100	42.9	1.8	282	1.088		
341	16:24:11	16:24:57	V6	75	-6	100	42.4	2.7	287	1.088	51	Gunshots during run
908	16:35:57	16:36:57	AMB				43.9	0.7	207	1.085		
												Light Config, GW:4090, Fuel: 131, CG: 135.5
342	17:31:46	17:32:26	V1	80	0	100	46.7	1.6	279	1.080	50	
343	17:34:19	17:35:05	V2	78	0	100	46.8	0.6	255	1.078		
344	17:37:04	17:37:37	V3	105	0	100	47.1	1.1	325	1.078		
345	17:39:28	17:40:01	V4	102	0	100	47.9	0.9	337	1.078		
346	17:41:28	17:42:12	V5	80	-6	100	47.1	1.6	314	1.079		
347	17:43:59	17:44:44	V6	78	-6	100	46.8	1.1	324	1.079	42	
348	17:46:32	17:47:14	V1	80	0	100	48.0	0.4	272	1.077		
349	17:49:00	17:49:41	V2	78	0	100	47.3	1.5	312	1.078		
350	17:51:32	17:52:07	V3	105	0	100	47.8	1.4	339	1.077		
351	17:54:02	17:54:53	V4	102	0	100	47.6	1.3	328	1.077		
352	17:56:20	17:57:03	V5	80	-6	100	47.6	2.2	357	1.077		

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Table 30: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
353	17:58:56	17:59:41	V6	78	-6	100	48.6	0.9	25	1.076	39	
354	18:01:38	18:02:19	V1	80	0	100	48.5	0.6	333	1.075		
355	18:04:14	18:04:56	V2	80	0	100	48.2	0.9	333	1.076		
356	18:06:50	18:07:21	V3	105	0	100	48.3	1.9	226	1.077		
357	18:09:10	18:09:42	V4	104	0	100	48.3	1.0	200	1.075		
358	18:11:25	18:12:11	V5	80	-6	100	48.7	1.0	147	1.074		
359	18:13:58	18:14:43	V6	80	-6	100	49.4	0.9	167	1.075	30	
360	18:16:38	18:17:20	V1	80	0	100	49.1	1.1	144	1.073		
361	18:19:14	18:19:54	V2	80	0	100	48.7	1.3	132	1.074		
362	18:21:52	18:22:25	V3	105	0	100	48.9	2.4	189	1.074		
363	18:24:28	18:24:59	V4	104	0	100	49.4	1.1	150	1.072		
364	18:26:44	18:27:28	V5	80	-6	100	49.2	1.4	215	1.074		
365	18:29:12	18:29:55	V6	80	-6	100	49.5	1.9	216	1.074	22	
366	18:31:48	18:32:30	V1	80	0	100	49.2	1.8	208	1.073		
367	18:34:07	18:34:52	V2	80	0	100	49.5	1.2	180	1.072		
368	18:36:32	18:37:04	V3	105	0	100	49.8	1.4	174	1.072		
369	18:38:57	18:39:30	V4	104	0	100	49.6	2.5	204	1.073		
370	18:41:17	18:41:59	V5	80	-6	100	49.8	2.2	229	1.072		
371	18:43:43	18:44:25	V6	80	-6	100	49.6	2.0	262	1.072	19	

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Table 30: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
372	18:46:23	18:47:04	V1	80	0	100	49.9	1.4	254	1.072		
373	18:49:01	18:49:33	V3	105	0	100	49.9	2.1	260	1.072		
374	18:51:20	18:52:04	V5	80	-6	100	50.5	0.9	248	1.070		
375	18:54:00	18:54:40	V2	80	0	100	50.6	1.4	315	1.071		
376	18:56:24	18:56:55	V4	104	0	100	50.8	0.6	255	1.068	13	
909	19:03:22	19:04:21	AMB				50.9	0.4	290	1.069		

Times are UTC (LOCAL: 0604, UTC 1304)

Table 31: Flight 044 Test Card, 2/13/15, AS350SD1, Salton Sea, 0 Feet.

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
912	14:14:44	14:16:20	AMB				61.9	1.6	325	1.207		ANTS On 14:27
401	14:59:49	15:00:37	V1	80	0.0	100	64.9	0.6	261	1.202		Truck in vicinity
402	15:02:28	15:03:04	V2	94	0.0	100	65.3	0.6	232	1.200	90	
403	15:04:44	15:05:20	V3	105	0.0	100	66.4	0.9	271	1.200		Explosion, OD M1, M21
404	15:09:18	15:09:48	V4	118	0.0	100	66.2	1.4	334	1.198		Max Spd 120kt
405	15:11:42	15:12:20	V3	105	0.0	100	66.1	1.1	246	1.199		Jet in area
406	15:14:22	15:14:54	V4	119	0.0	100	65.5	1.8	301	1.200		
407	15:17:08	15:17:40	V3	105	0.0	100	65.3	1.1	297	1.201		
408	15:20:01	15:20:35	V4	119	0.0	100	66.8	0.7	248	1.198	80	
409	15:22:54	15:23:31	V3	105	0.0	100	67.9	0.5	230	1.195		
410	15:25:41	15:26:12	V4	119	0.0	100	70.5	1.3	160	1.189		
411	15:28:17	15:28:54	V3	105	0.0	100	69.3	1.4	125	1.193		
412	15:31:12	15:31:45	V4	122	0.0	100	69.6	1.2	128	1.191		
413	15:34:03	15:34:39	V3	105	0.0	100	68.9	0.8	125	1.191		Train + Train Whistle
414	15:36:51	15:37:23	V4	121	0.0	100	73.6	0.0	51	1.183	70	
415	15:39:43	15:40:27	V5	80	-6.0	100	68.9	0.5	343	1.192		Balloon Raised to 250’
417	15:44:15	15:44:55	V6	97	-6.0	100	69.9	0.7	340	1.189		
418	15:46:45	15:47:24	V16	97	-4.5	100	69.8	1.1	216	1.193		Jet in area
419	15:49:28	15:50:08	V17	97	-7.5	100	71.7	0.5	140	1.182	64	Jet in area

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Table 31: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	WS Kts	WD °	Dens kg/m^3	Fuel %	Comments
420	15:52:45	15:53:34	V1	80	0.0	100	75.0	0.0	170	1.177		Jet in area
421	15:55:48	15:56:26	V2	100	0.0	100	73.4	0.4	79	1.181		
422	15:58:42	15:59:30	V5	80	-6.0	100	70.5	0.9	76	1.188		
423	16:01:34	16:02:16	V6	97	-6.0	100	69.0	1.8	347	1.191		
424	16:04:31	16:05:15	V16	96	-4.5	100	68.5	2.3	327	1.192		Train + Train Whistle
425	16:07:32	16:08:17	V17	96	-7.5	100	68.8	1.6	336	1.192	59	
426	16:10:41	16:11:31	V1	80	0.0	100	68.7	1.1	302	1.193		Jet in area
427	16:13:47	16:14:26	V2	96	0.0	100	68.4	1.0	309	1.192		
428	16:16:24	16:17:14	V5	80	-6.0	100	69.1	1.2	332	1.192		
429	16:19:17	16:20:00	V6	97	-6.0	100	68.5	2.5	317	1.192		
430	16:22:08	16:22:53	V1	80	0.0	100	68.1	2.4	313	1.193		
431	16:24:57	16:25:39	V2	96	0.0	100	68.2	2.0	308	1.193	50	
432	16:27:39	16:28:27	V5	80	-6.0	100	67.9	1.5	301	1.193		
433	16:30:39	16:31:21	V6	96	-6.0	100	69.0	1.5	316	1.191		
434	16:33:37	16:34:25	V1	80	0.0	100	69.6	2.8	331	1.190		
435	16:37:43	16:38:24	V2	97	0.0	100	71.5	4.4	338	1.186	45	
913	16:41:39	16:42:38	AMB				69.9	5.4	344	1.190		
												Refuel
436	17:30:15	17:31:02	V1	80	0.0	100	70.5	5.8	273	1.189	95	

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Table 31: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
437	17:33:04	17:33:44	V2	97	0.0	100	70.7	5.0	262	1.189		
438	17:35:40	17:36:20	V3	105	0.0	100	70.2	5.5	250	1.189		
439	17:38:32	17:39:03	V4	122	0.0	100	70.9	4.0	237	1.187		Max Spd 120kt
440	17:41:39	17:42:30	V5	80	-6.0	100	70.5	4.9	235	1.187		
441	17:45:18	17:46:01	V6	96	-6.0	100	70.3	5.5	258	1.189		
442	17:48:55	17:49:38	V16	96	-4.5	100	71.0	4.7	270	1.188		
443	17:52:04	17:52:51	V17	96	-7.5	100	70.6	4.5	250	1.188	81	
444	17:54:58	17:55:43	V1	80	0.0	100	70.9	6.0	253	1.189		
445	17:57:47	17:58:26	V2	96	0.0	100	70.7	4.5	240	1.186		
446	18:00:47	18:01:26	V3	105	0.0	100	71.2	4.4	220	1.187		
447	18:03:29	18:04:04	V4	121	0.0	100	71.3	4.4	234	1.187		Max Spd Achieved 120kt
448	18:06:38	18:07:30	V5	80	-6.0	100	72.2	2.9	244	1.185		
449	18:10:01	18:10:45	V6	98	-6.0	100	73.1	4.6	289	1.184	75	
450	18:13:14	18:14:02	V1	80	0.0	100	72.8	3.8	276	1.185		
451	18:16:14	18:17:06	V2	98	0.0	100	72.5	4.7	250	1.185		
452	18:19:09	18:19:49	V6	97	-6.0	100	72.0	6.0	245	1.187		
453	18:21:46	18:22:37	V5	80	-6.0	100	72.7	9.3	224	1.185		
454	18:24:34	18:25:20	V1	80	0.0	100	72.5	4.5	227	1.183	69	OD M21 (Wind)
455	18:27:16	18:27:56	V2	98	0.0	100	72.1	5.7	242	1.184		OD M21 (Wind)

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Table 31: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
												Jet in area
456	18:29:51	18:30:41	V5	80	-6.0	100	71.7	6.1	244	1.187		Jet in area
457	18:32:45	18:33:27	V6	98	-6.0	100	71.9	4.7	267	1.185		
458	18:35:30	18:36:15	V1	80	0.0	100	71.7	4.4	276	1.185		
459	18:38:16	18:38:54	V2	98	0.0	100	71.0	6.0	253	1.186		
460	18:40:58	18:41:43	V5	80	-6.0	100	71.7	4.2	272	1.185		
461	18:44:38	18:45:19	V6	98	-6.0	100	72.2	2.7	295	1.183	59	Jet in area
462	18:47:30	18:48:15	V1	80	0.0	100	73.0	3.2	289	1.182		
463	18:50:17	18:50:55	V2	98	0.0	100	72.6	3.9	269	1.183		Jet in area
464	18:52:43	18:53:32	V5	80	-6.0	100	73.6	4.9	292	1.181		
465	18:55:37	18:56:18	V6	98	-6.0	100	73.4	5.4	302	1.182	55	
466	18:58:25	18:59:09	V1	80	0.0	100	73.8	4.4	260	1.181		
467	19:01:12	19:01:47	V2	98	0.0	100	73.0	4.7	249	1.181		
468	19:03:58	19:04:45	V5	80	-6.0	100	73.5	5.0	278	1.181		
469	19:06:46	19:07:29	V6	99	-6.0	100	72.9	7.0	278	1.181	50	
914	19:13:53	19:14:52	AMB				73.5	4.6	252	1.180		

Times are UTC (LOCAL: 0602, UTC 1402)

Table 32: Flight 045 Test Card, 2/14/15, AS350 SD1, Salton Sea, 0 Feet.

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
915	13:25:45	13:26:44	AMB				65.2	2.7	334	1.196		
501	14:41:52	14:42:34	V1	80	0.0	100	72.0	4.5	337	1.182	98	Bad run
502	14:45:32	14:46:09	V2	96	0.0	100	71.8	4.2	344	1.182		Bad run
503	14:47:52	14:48:27	V3	105	0.0	100	72.1	5.7	350	1.182		
504	14:50:41	14:51:11	V4	122	0.0	100	71.9	4.5	350	1.183		Max Spd 120kt
505	14:53:15	14:53:51	V3	105	0.0	100	71.9	4.3	347	1.182		
506	14:55:51	14:56:25	V4	122	0.0	100	72.1	3.5	346	1.181		Max Spd 120kt
507	14:58:16	14:58:51	V3	105	0.0	100	72.3	3.6	351	1.181		
508	15:00:41	15:01:14	V4	122	0.0	100	72.5	3.2	3	1.181	81	Max Spd 120kt
509	15:03:14	15:04:03	V5	80	-6.0	100	72.7	3.2	9	1.180		
510	15:05:43	15:06:22	V6	98	-6.0	100	72.6	2.7	16	1.180		
511	15:07:58	15:08:40	V16	98	-4.5	100	72.9	2.4	25	1.180		
512	15:10:35	15:11:15	V17	98	-7.5	100	73.5	2.2	43	1.178		
513	15:13:03	15:13:46	V1	80	0.0	100	74.2	2.2	48	1.177		
514	15:15:53	15:16:28	V2	100	0.0	100	74.0	1.9	75	1.178	75	
515	15:18:15	15:19:02	V5	80	-6.0	100	74.1	1.8	78	1.177		
516	15:20:46	15:21:26	V6	100	-6.0	100	74.2	2.3	80	1.177		
517	15:23:18	15:23:54	V16	100	-4.5	100	74.1	2.5	83	1.178		
518	15:26:09	15:26:49	V17	100	-7.5	100	74.2	2.5	92	1.178		

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Table 32: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
519	15:28:30	15:29:14	V1	80	0.0	100	74.4	2.4	94	1.177		
520	15:30:55	15:31:28	V2	100	0.0	100	74.4	2.2	101	1.177		
521	15:33:18	15:34:04	V5	80	-6.0	100	74.2	1.9	111	1.178		
522	15:35:52	15:36:27	V6	100	-6.0	100	73.9	2.3	104	1.178		
523	15:38:32	15:39:15	A1	80	-3.0	100	74.2	2.4	102	1.176		
524	15:40:58	15:41:41	A1	80	-3.0	100	75.0	1.1	110	1.176	63	
525	15:43:48	15:44:37	A2	80	-9.0	100	77.7	1.7	163	1.170		
526	15:46:37	15:47:26	A2	80	-9.0	100	74.9	1.1	210	1.176		
527	15:49:18	15:49:58	A3	100	-3.0	100	73.8	1.9	236	1.179		
528	15:51:52	15:52:27	A3	100	-3.0	100	73.2	2.9	228	1.180		
529	15:54:40	15:55:42	A4	60	-3.0	100	72.6	3.9	239	1.182		
530	15:57:29	15:58:27	A4	60	-3.0	100	71.4	4.8	240	1.186	58	
531	16:00:30	16:01:33	A5	60	-6.0	100	70.8	4.2	224	1.186		
532	16:03:21	16:04:20	A5	60	-6.0	100	69.3	2.7	261	1.188		
533	16:06:20	16:07:23	A6	60	-9.0	100	67.8	3.5	237	1.192		
534	16:09:18	16:10:24	A6	60	-9.0	100	68.3	3.0	241	1.192		OD M21
535	16:12:38	16:13:15	V3	105	0.0	100	66.6	3.7	235	1.195	50	
536	16:15:03	16:15:34	V4	119	0.0	100	64.6	4.4	230	1.200		
537	16:17:28	16:18:05	V3	105	0.0	100	64.2	3.5	255	1.200		

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Table 32: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	WS Kts	WD °	Dens kg/m^3	Fuel %	Comments
538	16:20:13	16:20:43	V4	118	0.0	100	62.3	4.0	236	1.202		
539	16:22:23	16:22:59	V3	105	0.0	100	61.7	5.0	252	1.205		
540	16:24:48	16:25:21	V4	118	0.0	100	61.0	5.5	257	1.205		
541	16:27:03	16:27:37	V3	105	0.0	100	61.4	3.9	261	1.204	42	Train + Train Whistle
542	16:29:34	16:30:06	V4	117	0.0	100	62.0	3.5	276	1.204		
543	16:32:03	16:32:37	V3	105	0.0	100	61.6	4.7	279	1.203		
544	16:34:19	16:34:47	V4	117	0.0	100	61.2	3.9	269	1.204		
545	16:36:54	16:37:31	V3	105	0.0	100	61.7	4.3	271	1.205		Gain maybe bad
546	16:39:42	16:40:16	V4	117	0.0	100	62.7	3.2	261	1.202	35	
547	16:42:00	16:42:37	V3	105	0.0	100	62.1	3.5	283	1.202		
548	16:44:12	16:44:45	V4	118	0.0	100	62.7	2.4	269	1.201		
549	16:46:30	16:47:07	V3	105	0.0	100	63.4	2.2	277	1.200		
550	16:48:51	16:49:25	V4	118	0.0	100	63.6	1.7	247	1.197		
551	16:51:00	16:51:36	V3	105	0.0	100	63.4	2.0	263	1.200		
552	16:53:15	16:53:49	V4	118	0.0	100	64.0	1.4	238	1.200	25	
916	16:58:59	17:00:02	AMB				66.4	0.7	312	1.194		
												Refuel, Return @ 4400
553	17:57:14	17:58:00	V1	80	0.0	100	72.9	2.5	159	1.180	99	
554	17:59:51	18:00:24	V2	100	0.0	100	74.9	2.0	175	1.179		

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Table 32: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
555	18:01:57	18:02:47	V5	80	-6.0	100	74.2	2.7	130	1.180		
556	18:04:29	18:05:08	V6	100	-6.0	100	74.1	2.2	165	1.181		ATV/Dirtbike on road
557	18:06:52	18:07:33	V6	100	-6.0	100	76.4	2.0	180	1.177		
558	18:09:28	18:10:05	V16	100	-4.5	100	79.5	0.9	201	1.170		
559	18:11:46	18:12:29	V17	100	-7.5	100	74.7	1.6	145	1.180		
560	18:14:11	18:14:54	V1	80	0.0	100	77.0	0.9	172	1.170		
561	18:16:38	18:17:16	V2	100	0.0	100	77.0	2.5	158	1.173		
562	18:19:00	18:19:44	V5	80	-6.0	100	74.3	1.4	133	1.173		
563	18:21:33	18:22:08	V6	101	-6.0	100	75.1	2.8	158	1.177		
564	18:23:54	18:24:35	V16	100	-4.5	100	75.5	3.0	137	1.177		
565	18:26:22	18:27:00	V17	100	-7.5	100	76.3	2.9	126	1.175		
566	18:29:17	18:30:36	L6	40	0.0	100	78.4	1.6	148	1.170		
567	18:32:32	18:33:53	L6	40	0.0	100	79.2	0.8	128	1.164		
568	18:35:47	18:37:12	L6	40	0.0	100	79.7	1.6	189	1.171		
569	18:39:03	18:39:56	L2	60	0.0	100	79.3	1.6	229	1.170		
570	18:41:47	18:42:44	L2	60	0.0	100	75.9	2.2	179	1.168		
571	18:44:30	18:45:29	L2	60	0.0	100	80.0	1.8	109	1.165		
917	18:52:38	18:53:37	AMB				76.1	4.3	240	1.172	71	

Times are UTC (LOCAL: 0604, UTC 1404)

Table 33: Flight 046 Test Card, 2/15/15, AS350 SD1, Salton Sea, 0 Feet.

NASA	Data	Data	Cond	KIAS	FPA	N_R	Balloon				Fuel	Comments
Run	On	Off	Ctr				T	WS	WD	Dens		
Num	Time	Time			°	%	°F	Kts	°	kg/m^3	%	
918	14:30:17	14:31:16	AMB				65.6	1.0	179	1.191		
601	14:59:06	14:59:56	V1	80	0.0	100	65.6	2.5	196	1.191	99	M7 Gain bad, maybe 114?
602	15:01:23	15:02:02	V2	94	0.0	100	65.4	2.4	213	1.191		
603	15:03:37	15:04:10	V3	105	0.0	100	65.5	2.7	196	1.191		
604	15:05:40	15:06:12	V4	119	0.0	100	65.6	3.7	192	1.191		
605	15:07:48	15:08:22	V3	105	0.0	100	65.6	3.5	180	1.191		
606	15:10:01	15:10:37	V4	119	0.0	100	65.8	2.1	180	1.191		
607	15:12:20	15:12:56	V3	105	0.0	100	66.7	3.1	159	1.188		
608	15:14:42	15:15:31	V4	120	0.0	100	67.5	4.6	166	1.186	85	
609	15:17:03	15:17:36	V3	105	0.0	100	68.3	3.2	171	1.185		
610	15:19:30	15:20:01	V4	121	0.0	100	68.3	3.9	162	1.185		Max Spd 120kt
611	15:21:45	15:22:31	V5	80	-6.0	100	68.0	3.7	168	1.186		
612	15:24:15	15:24:56	V6	96	-6.0	100	67.8	4.2	169	1.186		
613	15:26:44	15:27:26	V16	96	-4.5	100	68.3	4.4	159	1.185		
614	15:29:21	15:30:01	V17	96	-7.5	100	68.5	3.8	154	1.185		
615	15:31:54	15:32:42	V1	80	0.0	100	68.5	4.0	159	1.185	79	
616	15:34:28	15:35:04	V2	96	0.0	100	68.3	3.7	171	1.186		
617	15:36:47	15:37:31	V5	80	-6.0	100	68.3	3.4	179	1.186		
618	15:39:24	15:40:06	V6	96	-6.0	100	68.5	3.0	175	1.186		

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Table 33: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
619	15:41:59	15:42:39	V16	96	-4.5	100	67.6	3.4	190	1.188		
620	15:44:35	15:45:17	V17	96	-7.5	100	67.5	3.7	186	1.190	71	
621	15:47:21	15:48:06	V1	80	0.0	100	68.1	3.4	172	1.187		
622	15:49:45	15:50:21	V2	96	0.0	100	67.5	3.9	177	1.188		
623	15:52:08	15:52:55	V5	80	-6.0	100	67.7	4.4	184	1.189		
624	15:54:41	15:55:21	V6	96	-6.0	100	67.8	4.4	177	1.188	68	
625	15:57:00	15:57:44	V1	80	0.0	100	67.3	4.5	181	1.188		
626	15:59:34	16:00:13	V2	96	0.0	100	66.6	4.2	180	1.188		
627	16:02:05	16:02:45	V6	96	-6.0	100	67.4	3.5	177	1.187		
628	16:05:33	16:06:18	V5	80	-6.0	100	67.8	3.0	177	1.187		OD M12, M13
629	16:07:57	16:08:44	V1	80	0.0	100	68.1	2.4	189	1.189	60	
630	16:10:26	16:11:04	V2	96	0.0	100	68.4	2.4	176	1.186		
631	16:12:58	16:13:46	V5	80	-6.0	100	69.7	2.5	161	1.185		
632	16:15:53	16:16:35	V6	96	-6.0	100	66.8	1.5	110	1.184		
633	16:18:27	16:19:10	V1	80	0.0	100	68.8	1.6	161	1.184		
634	16:20:45	16:21:25	V2	96	0.0	100	68.2	1.5	106	1.187	55	
635	16:23:18	16:24:06	V5	80	-6.0	100	67.8	1.8	118	1.183		
636	16:25:52	16:26:34	V6	96	-6.0	100	66.8	1.8	176	1.185		
637	16:28:31	16:29:17	V1	80	0.0	100	68.5	2.1	136	1.188		

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Table 33: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	WS Kts	WD °	Dens kg/m^3	Fuel %	Comments
638	16:30:54	16:31:33	V2	96	0.0	100	69.5	1.3	162	1.180		ATV on road
639	16:33:13	16:33:57	V5	80	-6.0	100	72.0	0.4	26	1.179	50	
640	16:35:50	16:36:31	V6	96	-6.0	100	69.6	2.1	107	1.191		
641	16:38:20	16:39:01	V1	80	0.0	100	66.2	4.1	104	1.190		
642	16:40:45	16:41:24	V2	95	0.0	100	66.0	3.7	112	1.190		
643	16:42:55	16:43:30	V4	119	0.0	100	67.0	4.6	150	1.189		
644	16:45:16	16:56:49	V3	105	0.0	100	66.9	3.4	6	1.190	45	
645	16:47:41	16:48:26	V5	80	-6.0	100	67.1	3.9	134	1.192		
646	16:50:19	16:50:59	V6	96	-6.0	100	66.3	3.9	122	1.188		
647	16:52:41	16:53:25	V1	80	0.0	100	67.0	4.0	111	1.187		OD M1
648	16:55:14	16:55:47	V2	96	0.0	100	66.7	5.7	116	1.189		
649	16:57:34	16:58:19	V5	80	-6.0	100	66.0	8.5	123	1.193		
650	17:00:15	17:00:58	V6	94	-6.0	100	66.6	4.5	116	1.186	39	
919	17:08:07	17:09:07	AMB				68.1	6.0	166	1.185		

Times are UTC (LOCAL: 0604, UTC 1404)

Table 34: Flight 047 Test Card, 2/16/15, AS350 SD1, Salton Sea, 0 Feet.

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
920	14:29:07	14:30:07	AMB				59.7	2.4	260	1.201		
921	16:18:30	16:29:44	AMB				66.9	0.9	170	1.185		Long ambient
												train at end
701	17:54:11	17:54:47	V3	105	0.0	100	67.7	2.7	157	1.185	52	Balloon @300'@17:35
702	17:56:38	17:57:08	V4	120	0.0	100	65.5	5.0	149	1.188		
703	17:58:49	17:59:23	V3	105	0.0	100	67.8	4.1	175	1.185		
704	18:01:10	18:01:44	V4	119	0.0	100	65.9	5.0	146	1.189		
705	18:03:36	18:04:09	V4	120	0.0	100	67.4	4.9	160	1.188	49	
706	18:05:56	18:06:33	V3	105	0.0	100	67.3	5.2	138	1.186		
707	18:08:20	18:08:49	V4	120	0.0	100	66.5	4.6	138	1.185		
708	18:10:32	18:11:07	V3	105	0.0	100	68.5	5.3	129	1.182		
709	18:12:50	18:13:22	V4	119	0.0	100	67.0	5.5	130	1.187	41	
710	18:15:16	18:15:52	V3	105	0.0	100	66.8	5.6	135	1.186		
711	18:17:43	18:18:26	V5	80	-6.0	100	68.1	4.8	153	1.183		
712	18:20:08	18:20:47	V6	95	-6.0	100	68.0	7.1	112	1.181		
713	18:22:42	18:23:19	V16	95	-4.5	100	68.6	3.8	168	1.184		
714	18:25:06	18:25:48	V17	95	-7.5	100	68.4	5.9	142	1.181	38	
715	18:27:26	18:28:09	V5	80	-6.0	100	68.8	6.6	154	1.183		
716	18:30:02	18:30:43	V6	96	-6.0	100	68.5	5.7	130	1.181		

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Table 34: *continued.*

NASA Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WD °	Balloon Dens kg/m^3	Fuel %	Comments
717	18:32:31	18:33:11	V16	96	-4.5	100	68.5	6.0	129	1.181		
718	18:34:42	18:35:26	V17	96	-7.5	100	68.4	6.2	168	1.180	31	OD M1
719	18:37:22	18:38:05	V1	80	0.0	100	69.0	5.3	165	1.182		
720	18:39:37	18:40:15	V2	96	0.0	100	69.1	7.9	172	1.181	30	
922	18:48:28	18:49:28	Ambient				68.2	5.3	195	1.180		ATV in 1st 30s AMB

Times are UTC (LOCAL: 0604, UTC 1404)

Table 35: Flight 279 Test Card, 10/6/2014, EH-60L, Sweetwater, 7000 Feet.

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	WS Kts	WH °	Dens kg/m^3	Comments
912		13:10:38	13:11:38	AMB				52.2	2.7	110	0.967	
500	1	14:53:21	14:54:11	V7	80	0	100.0	54.4	1.8	107	0.963	Army 358
501	2	14:59:11	14:59:55	V7	80	0	100.0	55.4	2.1	108	0.962	
502	3	15:02:26	15:03:12	V8	72	0	100.5	56.1	2.2	0	0.961	
503	4	15:05:19	15:05:50	V9	125	0	100.0	57.6	0.9	135	0.957	
504	5	15:07:45	15:08:35	V10	113	0	100.5	57.6	0.8	132	0.957	
505	6	15:11:25	15:12:08	V11	80	-6	100.0	58.9	0.8	137	0.956	M24 OD
506	7	15:14:55	15:16:02	V12	72	-6	100.5	56.0	0.6	201	0.960	
507	8	15:18:24	15:18:58	V13	118	0	100.5	55.5	0.8	163	0.960	
508	9	15:21:15	15:22:01	V7	80	0	100.0	56.0	1.4	165	0.960	Changed ref RPM
509	10	15:24:33	15:25:19	V8	72	0	99.0	55.1	1.5	165	0.960	
510	11	15:27:19	15:28:04	V9	125	0	100.0	57.9	1.3	142	0.959	
511	12	15:30:13	15:30:59	V10	113	0	99.0	57.1	2.3	147	0.961	Changed ref a
512	13	15:33:31	15:34:22	V11	80	-6	100.0	55.6	2.3	152	0.962	
513	14	15:37:03	15:37:57	V12	71	-6	99.0	54.7	2.4	156	0.963	
514	15	15:40:05	15:40:48	V13	118	0	100.5	55.5	1.6	157	0.960	
515	16	15:43:17	15:44:12	V7	80	0	100.0	54.4	1.9	175	0.962	
516	17	15:46:42	15:47:34	V8	71	0	99.0	54.6	2.4	166	0.963	
517	18	15:49:44	15:50:27	V9	125	0	100.0	55.8	2.2	155	0.961	

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Table 35: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon Temp °F	Balloon Speed Kts	Balloon Heading °	Balloon Density kg/m^3	Comments
518	19	15:52:50	15:53:27	V10	111	0	99.0	56.0	2.4	160	0.961	
519	20	15:55:55	15:56:48	V11	80	-6	100.0	57.6	2.7	146	0.958	M24 OD
520	21	15:59:18	16:00:15	V12	71	-6	99.0	58.4	1.8	150	0.956	
521	22	16:02:18	16:03:09	V13	118	0	100.5	57.9	2.2	131	0.957	
522	23	16:05:24	16:06:06	V7	80	0	100.0	57.8	1.9	127	0.958	
523	24	16:08:23	16:09:17	V8	71	0	99.0	57.6	2.1	122	0.958	Truck on Side Road
												Cows by main array
524	25	16:11:24	16:11:59	V9	125	0	100.0	58.3	1.7	142	0.955	Cows by main array
525	26	16:14:24	16:15:01	V10	111	0	99.0	56.6	2.1	160	0.958	Cows maybe near M20-21
913		16:16:39	16:18:08	AMB				57.8	1.6	157	0.957	Truck on Side Road
												Refuel, M12 tripod down
914		16:46:28	16:47:28	AMB				60.3	2.1	154	0.954	helo return near end
526	27	16:52:03	16:52:51	V7	80	0	100.0	58.7	2.3	131	0.956	Prop Plane
527	28	16:55:09	16:56:08	V8	71	0	99.0	59.0	2.3	135	0.954	
528	29	16:58:29	16:59:04	V9	125	0	100.0	60.1	2.2	154	0.953	
529	30	17:01:14	17:01:50	V10	111	0	99.0	60.3	2.2	153	0.953	
530	31	17:04:14	17:05:05	V11	80	-6	100.0	60.9	1.8	147	0.952	
531	32	17:07:47	17:08:34	V12	71	-6	99.0	59.4	2.2	125	0.955	
532	33	17:11:03	17:11:43	V7	80	0	100.0	62.2	2.1	130	0.951	

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Table 35: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon Temp °F	Balloon Speed Kts	Balloon Heading °	Balloon Density kg/m^3	Comments
533	34	17:14:09	17:15:03	V8	71	0	99.0	61.3	1.7	151	0.952	Jet Overhead
534	35	17:17:17	17:17:52	V9	125	0	100.0	62.9	1.4	132	0.948	M12 off, Jet Overhead
535	36	17:20:11	17:20:48	V10	111	0	100.0	60.3	2.3	129	0.953	Jet present
536	37	17:23:13	17:24:10	V11	80	-6	100.0	60.8	2.5	135	0.951	
537	38	17:26:58	17:28:00	V12	71	-6	100.0	61.8	1.4	127	0.950	Mike thinks it's high
538	39	17:30:21	17:31:06	V7	80	0	100.0	62.0	1.7	121	0.949	M16 OD
539	40	17:33:30	17:34:24	V8	71	0	100.0	62.7	1.6	133	0.950	M28-29 OD
540	41	17:36:35	17:37:14	V9	125	0	100.0	63.0	2.9	117	0.947	
541	42	17:39:19	17:40:03	V10	111	0	100.0	62.7	2.9	164	0.950	M12 off
542	43	17:42:27	17:43:21	V11	80	-6	100.0	64.3	1.4	147	0.945	
543	44	17:45:59	17:47:00	V12	72	-6	100.0	62.8	2.9	139	0.947	
544	45	17:49:27	17:50:16	V7	80	0	100.0	62.8	1.6	138	0.947	
545	46	17:52:52	17:53:41	V8	72	0	100.0	62.3	2.2	177	0.950	
546	47	17:55:44	17:56:21	V9	125	0	100.0	63.8	2.6	150	0.946	
547	48	17:58:28	17:59:16	V10	112	0	100.0	63.7	2.0	137	0.947	
548	49	18:01:40	18:02:29	V11	80	-6	100.0	64.2	2.4	165	0.947	
549	50	18:05:03	18:06:00	V12	72	-6	100.0	64.3	2.2	152	0.945	
550	51	18:08:16	18:09:00	V7	80	0	100.0	64.9	3.0	157	0.947	
551	52	18:11:05	18:12:07	V8	72	0	100.0	63.7	2.6	136	0.947	

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Table 35: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon Temp °F	Balloon Speed Kts	Balloon Heading °	Balloon Density kg/m^3	Comments
552	53	18:14:04	18:14:47	V9	125	0	100.0	65.0	1.6	201	0.944	Winds swirling
553	54	18:16:54	18:17:35	V10	112	0	100.0	64.6	1.6	175	0.946	
554	55	18:19:56	18:20:44	V11	80	-6	100.0	65.9	0.9	135	0.943	M12 off
555	56	18:23:05	18:24:02	V12	72	-6	100.0	65.7	2.0	131	0.945	
915		18:32:35	18:33:34	AMB				65.9	2	122.0	0.944	

Times are UTC (LOCAL: 0643, UTC 1343)

Table 36: Flight 280 Test Card, 10/7/2014, EH-60L, Sweetwater, 7000 Feet.

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA	N_R	Balloon				Comments
						°	%	T °F	WS Kts	WH °	Dens kg/m^3	
916		13:13:34	13:14:34	AMB				54.4	2.3	118	0.961	
600	1	14:12:04	14:12:51	V7	80	0	100.0	54.3	1.6	135	0.961	Army 359, M17-18 OD
601	2	14:15:14	14:16:01	V8	71	0	99.0	54.6	1.9	168	0.960	190' alt
602	3	14:18:05	14:18:41	V9	125	0	100.0	53.9	2.2	168	0.962	
603	4	14:20:47	14:21:20	V10	111	0	99.0	54.3	2.1	174	0.961	
604	5	14:23:24	14:24:18	V11	80	-6	100.0	54.2	2.4	169	0.962	
605	6	14:26:36	14:27:37	V12	71	-6	99.0	54.2	2.5	169	0.962	
606	7	14:29:59	14:30:45	V7	80	0	100.0	54.1	1.9	172	0.961	
607	8	14:32:46	14:33:41	V8	71	0	99.0	54.0	1.9	177	0.962	Jet
608	9	14:35:38	14:36:20	V9	125	0	100.0	54.1	2.0	176	0.961	Jet
609	10	14:38:15	14:38:54	V10	111	0	99.0	54.0	1.9	170	0.962	
610	11	14:41:18	14:42:08	V11	80	-6	100.0	53.7	2.4	169	0.962	
611	12	14:44:27	14:45:13	V12	71	-6	99.0	54.1	1.9	176	0.962	
612	13	14:47:46	14:48:28	V7	80	0	100.0	54.7	1.9	166	0.960	Cattle noise from hwy
613	14	14:50:37	14:51:38	V8	71	0	99.0	54.4	1.9	161	0.961	
614	15	14:53:44	14:54:22	V9	125	0	100.0	55.2	2.0	164	0.960	
615	16	14:56:29	14:57:10	V10	111	0	99.0	56.7	1.4	154	0.957	ADS Data Corrupt
616		14:59:33	15:00:23	V11	80	-6	100.0	56.6	1.9	157	0.957	ADS Data Corrupt
617		15:02:55	15:03:45	V12	71	-6	99.0	56.9	1.8	169	0.957	ADS Data Corrupt

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Table 36: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
618		15:06:00	15:06:48	V7	80	0	100.0	57.2	1.6	169	0.956	ADS Data Corrupt
619		15:09:12	15:10:01	V8	71	0	99.0	57.2	1.6	158	0.955	Plane West ADS Data Corrupt
620		15:11:55	15:12:36	V9	125	0	100.0	57.6	1.9	143	0.955	ADS Data Corrupt
621		15:14:37	15:15:19	V10	111	0	99.0	57.6	1.9	146	0.955	ADS Data Corrupt
622		15:17:36	15:18:32	V11	80	-6	100.0	59.4	1.4	140	0.953	ADS Data Corrupt
623		15:21:04	15:22:00	V12	71	-6	99.0	58.8	2.0	141	0.955	ADS Data Corrupt
624		15:24:37	15:25:17	V7	80	0	100.0	57.8	1.9	145	0.955	ADS Data Corrupt
625		15:27:32	15:28:28	V8	71	0	99.0	57.4	2.5	140	0.954	ADS Data Corrupt
626		15:30:28	15:31:02	V9	125	0	100.0	57.9	2.2	135	0.955	ADS Data Corrupt
627		15:33:08	15:33:39	V10	111	0	99.0	56.6	2.2	154	0.957	ADS Data Corrupt
628		15:35:50	15:36:41	V11	80	-6	100.0	57.2	2.5	141	0.956	ADS Data Corrupt
629		15:38:55	15:39:41	V12	71	-6	99.0	56.2	1.9	144	0.958	ADS Data Corrupt
917		15:45:05	15:46:04	AMB				56.3	2.1	147	0.958	

Times are UTC (LOCAL: 0643, UTC 1343)

Table 37: Flight 281 Test Card, 10/8/2014, EH-60L, Sweetwater, 7000 Feet.

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
918		13:08:20	13:09:20	AMB				55.7	1.6	180	0.957	Balloon time: 06:48:50
980		13:24:02	13:24:37	PGS				52.9	0.4	198	0.962	Balloon time: 13:24:41
981		13:28:27	13:28:46	PGS				53.6	1.6	189	0.961	Balloon time corrected cannon at M11
982		13:29:24	13:30:15	PGS				53.1	1.4	182	0.962	
983		13:36:59	13:37:47	PGS				54.1	2.3	179	0.96	cannon at M1
700	1	14:05:22	14:06:04	V7	80	0	100.0	53.9	1.6	135	0.960	ADS Time Off, Army 361
701		14:08:18	14:08:26	V8	71	0	99.0					Aborted Run
702	2	14:09:40	14:10:21	V8	71	0	99.0	53.9	2.2	142	0.960	
703	3	14:12:23	14:13:00	V9	125	0	100.0	53.4	2.2	159	0.961	M18,19,20 OD
704	4	14:15:02	14:15:43	V10	110	0	99.0	54.0	2.1	154	0.960	
705	5	14:18:11	14:19:00	V11	80	-6	100.0	53.9	2.3	153	0.960	
706	6	14:21:35	14:22:22	V12	71	-6	99.0	53.3	2.6	160	0.961	
707	7	14:24:52	14:25:38	V7	80	0	100.0	54.3	3.1	145	0.960	
708	8	14:27:54	14:28:49	V8	71	0	99.0	53.9	3.2	150	0.960	
709	9	14:31:00	14:31:32	V9	125	0	100.0	53.0	3.2	161	0.962	
710	10	14:33:44	14:34:20	V10	111	0	99.0	52.7	3.0	178	0.963	
711	11	14:37:02	14:37:48	V11	80	-6	100.0	53.8	2.9	163	0.961	Birds to East
712	12	14:40:25	14:41:09	V12	72	-6	99.0	54.7	3.3	145	0.959	

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Table 37: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	WS Kts	WH °	Dens kg/m^3	Comments
713	13	14:43:45	14:44:30	V7	80	0	100.0	54.8	2.8	149	0.959	
714	14	14:46:55	14:47:42	V8	71	0	99.0	54.6	2.9	161	0.959	
715	15	14:49:52	14:50:29	V9	125	0	100.0	55.0	2.6	151	0.958	
716	16	14:52:45	14:53:22	V10	111	0	99.0	55.1	2.2	150	0.958	
717	17	14:55:43	14:56:26	V11	80	-6	100.0	55.2	2.1	154	0.958	
718	18	14:58:56	14:59:43	V12	71	-6	99.0	55.4	1.9	153	0.957	
719	19	15:02:03	15:02:45	V7	80	0	100.0	55.1	2.2	164	0.958	
720	20	15:05:08	15:05:55	V8	71	0	99.0	55.8	1.4	144	0.956	
721	21	15:08:05	15:08:32	V9	125	0	100.0	56.0	2.4	138	0.956	Mics started late
722	22	15:10:39	15:11:22	V10	111	0	99.0	55.3	2.2	153	0.958	
723	23	15:13:43	15:14:30	V11	80	-6	100.0	55.9	2.2	144	0.957	
724	24	15:17:00	15:17:46	V12	71	-6	99.0	56.4	2.2	140	0.956	
725	25	15:21:02	15:22:18	V7	80	0	100.0	55.8	2.9	138	0.957	Extended 9000' app
726	26	15:25:20	15:26:59	V8	71	0	99.0	56.1	2.7	135	0.957	Extended 9000' app
727	27	15:29:53	15:30:54	V9	125	0	100.0	56.3	2.4	142	0.956	Extended 9000' app
728	28	15:33:55	15:35:03	V10	111	0	99.0	55.9	2.2	144	0.957	Extended 9000' app
729	29	15:37:48	15:38:30	V11	80	-6	100.0	57.1	2.4	139	0.954	
730	30	15:41:20	15:42:07	V12	71	-6	99.0	56.4	2.2	145	0.954	Vehicle on dirt road Refuel

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Table 37: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	WS Kts	WH °	Dens kg/m^3	Comments
731	31	16:16:19	16:17:01	V7	80	0	100.0	59.0	3.4	143	0.951	M29 Not Responding
732	32	16:19:26	16:20:12	V8	71	0	99.0	58.7	2.4	123	0.952	M29 Not Responding
733	33	16:22:26	16:23:00	V9	125	0	100.0	59.3	1.6	124	0.950	M29 Responding
734	34	16:25:16	16:25:49	V10	111	0	99.0	59.1	2.0	126	0.951	
735	35	16:28:11	16:28:55	V11	80	-6	100.0	60.5	1.6	143	0.950	
736	36	16:31:37	16:32:21	V12	71	-6	99.0	58.5	2.2	148	0.948	
737	37	16:34:38	16:35:20	V7	80	0	100.0	58.9	2.3	154	0.951	
738	38	16:37:45	16:38:35	V8	71	0	99.0	60.3	2.1	146	0.949	Diesel truck
739	39	16:40:39	16:41:12	V9	125	0	100.0	60.5	2.2	136	0.949	
740	40	16:43:21	16:43:53	V10	111	0	99.0	60.1	2.1	139	0.948	
741	41	16:46:04	16:46:48	V11	80	-6	100.0	60.7	2.2	135	0.948	
742	42	16:49:10	16:49:55	V12	71	-6	99.0	61.0	2.2	158	0.947	
743	43	16:52:00	16:52:44	V7	80	0	100.0	61.4	2.1	138	0.947	Truck on dirt road
744	44	17:00:23	17:01:09	V8	71	0	100.0	62.0	2.1	128	0.945	Truck on dirt road
745	45	17:03:06	17:03:36	V9	125	0	100.0	61.7	2.2	149	0.944	
746	46	17:05:36	17:06:08	V10	111	0	100.0	62.7	2.1	119	0.946	
747	47	17:08:28	17:09:07	V11	80	-6	100.0	62.6	2.2	109	0.943	
748	48	17:11:23	17:12:11	V12	71	-6	100.0	64.0	2.0	152	0.943	
749	49	17:14:23	17:15:03	V7	80	0	100.0	63.6	2.2	166	0.945	

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Table 37: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
750	50	17:17:14	17:18:02	V8	72	0	100.0	66.0	2.2	142	0.942	
751	51	17:20:08	17:20:38	V9	125	0	100.0	63.4	2.8	162	0.945	Jet
752	52	17:22:48	17:23:21	V10	111	0	100.0	64.0	1.6	147	0.943	
753	53	17:25:42	17:26:21	V11	80	-6	100.0	62.6	1.9	165	0.945	
754	54	17:28:41	17:29:27	V12	72	-6	100.0	62.6	2.3	113	0.945	ATV's by M24
755	55	17:31:36	17:32:05	V9	125	0	100.0	64.2	2.2	113	0.943	Truck on dirt road
919		17:39:31	17:40:31	AMB				63.1	2.2	87	0.941	

Times are UTC (LOCAL: 0643, UTC 1343)

Table 38: Flight 310 Test Card, 11/6/2014, EH-60L, Amedee, 4000 Feet.

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA	N_R	Balloon				Comments
						°	%	T °F	WS Kts	WH °	Dens kg/m^3	
910		14:41:19	14:42:18	AMB				43.1	2.5	277	1.093	Balloon:09:40:10 UTC:14:39:04 Balloon+4:58:54
911		15:00:48	15:01:47	AMB				38.7	6.2	302	1.103	
100	1	15:19:57	15:20:45	V7	80	0	100.0	44.7	1.3	66	1.089	Army flight 362
101	2	15:23:47	15:24:40	V8	75	0	98.0	46.9	0.6	78	1.085	
102	3	15:27:27	15:27:59	V9	125	0	100.0	45.0	1.9	1	1.089	
103	4	15:30:51	15:31:23	V10	117	0	98.0	45.1	1.4	6	1.089	Coyotes howling
104	5	15:38:52	15:39:30	V11	80	-6	100.0	45.0	1.9	129	1.089	6-7kts fast
105	6	15:48:32	15:49:12	V12	75	-6	98.0	43.5	0.6	343	1.092	
106	7	15:52:13	15:52:57	V7	80	0	100.0	43.4	0.4	183	1.093	
107	8	15:57:16	15:58:02	V8	75	0	98.0	40.5	1.4	243	1.100	
108	9	16:01:16	16:01:45	V9	125	0	100.0	40.1	2.4	277	1.100	Blue pickup down runway
109	10	16:04:42	16:05:16	V10	117	0	97.0	36.0	7.4	304	1.110	Blue pickup down runway
110	11	16:08:02	16:08:41	V11	80	-6	100.0	39.8	4.4	312	1.100	Blue pickup down runway
111	12	16:11:15	16:12:04	V12	75	-6	97.0	38.9	3.9	314	1.103	Blue pickup down runway
112	13	16:14:12	16:14:50	V7	80	0	100.0	39.1	4.7	310	1.102	Blue pickup down runway
113	15	16:17:03	16:17:45	V8	75	0	97.0	39.4	5.6	309	1.102	Back-up beeps
114	16	16:19:53	16:20:22	V9	125	0	100.0	39.8	5.5	318	1.102	

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Table 38: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
115	17	16:22:49	16:23:17	V10	118	0	97.0	40.2	5.7	319	1.100	
116	18	16:25:36	16:26:15	V11	80	-6	100.0	38.6	4.6	306	1.105	
117	19	16:28:49	16:29:28	V12	75	-6	97.0	41.1	2.7	313	1.098	
118	20	16:31:46	16:32:24	V7	80	0	100.0	39.2	1.5	293	1.102	
119	21	16:34:42	16:35:23	V8	75	0	97.0	40.4	2.9	317	1.100	
120	22	16:37:36	16:38:06	V9	125	0	100.0	40.1	3.5	309	1.100	
121	23	16:40:17	16:40:46	V10	117	0	97.0	40.4	3.2	303	1.099	
122	24	16:43:14	16:43:51	V11	80	-6	100.0	40.1	2.7	330	1.100	M11 OD
123	25	16:46:01	16:46:43	V12	75	-6	97.0	40.7	3.2	334	1.098	
124	26	16:48:56	16:49:34	V7	80	0	100.0	41.4	2.0	348	1.097	
125	27	16:51:55	16:52:39	V8	75	0	97.0	39.9	2.7	66	1.101	
126	28	16:54:47	16:55:14	V9	125	0	100.0	40.0	2.7	39	1.101	
127	29	16:57:24	16:57:56	V10	117	0	97.0	40.6	2.9	59	1.100	
128	30	17:00:18	17:00:54	V11	80	-6	100.0	41.3	3.5	63	1.097	M24 OD
129	31	17:03:27	17:04:08	V12	75	-6	97.0	40.6	2.5	45	1.099	
912		17:10:47	17:11:48	AMB				45.3	2.7	107	1.088	
												Refuel, added 305.6 gal
130	1	18:32:41	18:33:19	V7	80	0	100.0	47.2	5.6	296	1.085	Army Flight 363
												M19 Not Functioning

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Table 38: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
131	2	18:35:33	18:36:11	V8	76	0	98.0	47.9	6.2	299	1.085	M19 Not Functioning
132	3	18:38:11	18:38:36	V9	125	0	100.0	48.0	4.5	287	1.084	M19 dead
133	4	18:40:22	18:40:49	V10	118	0	98.0	48.4	4.4	292	1.082	
134	5	18:42:44	18:43:22	V11	80	-6	100.0	48.8	5.4	263	1.081	
135	6	18:45:16	18:45:54	V12	76	-6	98.0	48.9	3.7	291	1.081	
136	7	18:47:48	18:48:27	V7	80	0	100.0	49.0	4.7	257	1.082	
137	8	18:50:15	18:50:54	V8	75	0	98.0	49.3	3.1	264	1.078	Airspeed variation
138	9	18:52:45	18:53:12	V9	125	0	100.0	49.8	3.2	276	1.079	
139	10	18:55:05	18:55:33	V10	117	0	98.0	50.3	2.1	277	1.078	
140	11	18:57:29	18:58:07	V11	80	-6	100.0	50.1	3.2	262	1.078	
141	12	19:00:11	19:00:51	V12	75	-6	98.0	50.0	2.7	293	1.079	
142	13	19:02:47	19:03:26	V7	80	0	100.0	50.3	2.7	269	1.077	
143	14	19:05:17	19:05:53	V8	75	0	98.0	50.3	3.2	274	1.078	
144	15	19:07:58	19:08:22	V9	125	0	100.0	50.4	3.0	261	1.077	
145	16	19:10:27	19:10:54	V10	117	0	98.0	51.2	3.9	277	1.076	
146	17	19:12:54	19:13:32	V11	80	-6	100.0	50.8	4.0	279	1.078	
147	18	19:15:36	19:16:14	V12	75	-6	97.0	50.8	6.0	303	1.076	
148	19	19:18:11	19:18:47	V7	80	0	100.0	51.4	2.2	269	1.075	
149	20	19:20:41	19:21:20	V8	75	0	98.0	50.5	4.6	280	1.077	

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Table 38: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
150	21	19:23:20	19:23:45	V9	125	0	100.0	51.2	2.9	280	1.075	
151	22	19:25:48	19:26:16	V10	117	0	99.0	51.5	3.9	302	1.075	
152	23	19:28:20	19:28:57	V11	80	-6	100.0	52.9	2.9	306	1.074	
153	24	19:31:14	19:31:53	V12	75	-6	99.0	52.0	3.1	273	1.074	
154	25	19:33:54	19:34:32	V7	80	0	100.0	51.4	4.5	251	1.075	
155	26	19:36:32	19:37:09	V8	75	0	99.0	52.2	5.5	290	1.073	
156	27	19:39:12	19:39:38	V9	125	0	100.0	52.3	5.3	261	1.074	
157	28	19:41:41	19:42:08	V10	117	0	99.0	52.4	4.4	258	1.073	
158	29	19:44:10	19:44:47	V11	80	-6	100.0	54.7	4.7	281	1.070	M8 OD
159	30	19:46:50	19:47:27	V12	75	-6	99.0	52.8	3.4	287	1.072	
160	31	19:49:28	19:50:08	V7	80	0	100.0	54.1	1.9	273	1.070	
161	32	19:52:10	19:52:48	V8	75	0	99.0	55.3	2.2	297	1.071	
162	33	19:54:57	19:55:24	V9	125	0	100.0	55.3	1.9	225	1.065	
163	34	19:57:35	19:57:59	V10	118	0	99.0	55.6	2.3	266	1.067	
164	35	20:00:01	20:00:38	V11	80	-6	100.0	55.5	2.2	259	1.065	
165	36	20:02:40	20:03:20	V12	75	-6	99.0	58.9	1.4	238	1.052	
166	37	20:05:46	20:06:18	M4	110	0	100.0	58.0	1.5	227	1.057	
167	38	20:08:12	20:08:40	M23	120	0	100.0	57.1	2.1	293	1.065	
168	39	20:10:34	20:11:09	M38	80	VAR	100.0	57.2	1.1	264	1.062	

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Table 38: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
169	40	20:12:55	20:13:24	M40	80	VAR	100.0	56.8	1.1	339	1.064	
170	41	20:15:25	20:16:03	M19	80	0	100.0	57.0	1.9	272	1.062	
171	42	20:18:11	20:18:49	M32	80	VAR	100.0	57.1	2.4	264	1.063	
172	43	20:20:34	20:21:28	M14	95	0	100.0	56.7	1.1	248	1.061	stop +700' X
173	44	20:24:26	20:25:05	M15	95	VAR	100.0	62.1	0.5	118	1.052	Push over -500' X
	45											ADS data zero

Times are UTC (LOCAL: 0643, UTC 1343)

Table 39: Flight 311 Test Card, 11/7/2014, EH-60L, Amedee, 4000 Feet.

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
913		14:30:43	14:31:42	AMB				44.9	2.3	130	1.089	
174	1	15:16:33	15:17:02	L4	110	0	100	46	2.1	243	1.088	Army flight number 364
175	2	15:19:27	15:20:04	M4	110	0	100	45.4	3.1	266	1.089	Slight climb during roll
176	3	15:21:46	15:22:24	M4	110	0	100	45.2	3.4	260	1.09	Slight climb during roll
177	4	15:24:04	15:24:39	M10	110	0	100	45.5	3.2	264	1.089	
178	5	15:26:16	15:26:51	M10	110	0	100	45.5	3.6	259	1.089	
179	6	15:28:19	15:28:57	M5	95	0	100	45.6	3.6	259	1.089	
180	7	15:30:37	15:31:19	M5	95	0	100	45.8	3.3	258	1.089	
181	8	15:33:08	15:33:47	M11	95	0	100	45.7	3.4	249	1.089	Mic 1 and 27 overdriven
182	9	15:35:30	15:36:08	M11	95	0	100	45.8	3.4	248	1.089	
183	10	15:38:10	15:38:51	M11	95	0	100	45.9	2.6	253	1.088	
184	11	15:40:26	15:41:10	M6	65	0	100	46.3	1.9	253	1.087	
185	12	15:42:46	15:43:35	M6	65	0	100	46.9	0.9	250	1.086	
186	13	15:45:10	15:45:56	M12	65	0	100	46.7	0.6	296	1.087	
187	14	15:48:08	15:48:54	M12	65	0	100	51.7	0	125	1.077	
188	15	15:50:53	15:51:27	M22	120 varies	0	100	48.6	0.6	114	1.083	100 kt start decel
189	16	15:53:39	15:54:08	M23	120 varies	0	100	53.2	0.3	143	1.072	Roll Rate wrong
190	17	15:56:00	15:56:30	M23	120 varies	0	100	52.5	0.4	128	1.079	Good 90 kts at turn
												Prop plane in area at end

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Table 39: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
191	18	16:00:39	16:01:10	M23	120 varies	0	100	49.2	0.6	220	1.079	
192	19	16:02:59	16:03:34	M25	120 varies	0	100	46	1.1	257	1.088	
193	20	16:05:28	16:06:01	M25	120 varies	0	100	46.7	0.6	247	1.087	
194	21	16:08:17	16:09:11	M17	40-140	0	100	45.3	1.6	279	1.088	
195	22	16:11:23	16:12:19	M17	40-140	0	100	44	2.2	297	1.093	110kt over array
196	23	16:14:42	16:15:28	M17	40-140	0	100	43.9	2.5	301	1.093	Accel @ 4k', 125kt at array
197	24	16:18:07	16:18:55	M17	40-140	0	100	44.3	2.2	306	1.092	Accel @ 4k', 130kt at array
198	25	16:21:28	16:22:11	M38	80	0 to 6	100	46.2	1.8	336	1.088	
199	26	16:23:42	16:24:27	M38	80	0 to 6	100	44.8	2.4	326	1.091	
200	27	16:25:41	16:26:22	M39	80	0 to 6	100	45.4	1.9	340	1.09	
201	28	16:28:13	16:28:53	M39	80	0 to 6	100	47.1	1.6	358	1.086	
202	29	16:30:56	16:31:30	M40	80 to 50	0	100	47.3	1.6	0	1.086	
203	30	16:33:12	16:33:46	M40	80 to 50	0	100	46.9	1	338	1.087	
204	31	16:35:21	16:35:57	M41	80 to 50	0	100	48	0.9	341	1.084	Alt lost during maneuver
205	32	16:37:58	16:38:36	M41	80 to 50	0	100	50.4	0.4	0	1.079	
206	33	16:40:48	16:41:26	M19	80 varies	0	100	54.4	0	38	1.071	Balloon'd up on flight
207	34	16:43:13	16:43:54	M19	80 varies	0	100	57.9	0	62	1.062	
208	35	16:45:28	16:46:07	M19	80 varies	0	100	57	0	333	1.065	
209	36	16:47:48	16:48:25	M21	80 varies	0	100	56.5	0	359	1.067	

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Table 39: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
210	37	16:50:00	16:50:42	M21	80 varies	0	100	52.8	0.4	58	1.074	
												Refuel
914		17:20:00	17:20:59	AMB				48.7	2.2	265	1.083	
915	1	17:47:26	17:47:56	L4	110	0	100	41.5	1.8	111	1.071	Army flight number 365
212	2	17:50:05	17:50:44	M32	80	6	100	54.1	1.8	100	1.07	
213	3	17:52:15	17:52:56	M32	80	6	100	53.7	1.7	107	1.075	
214	4	17:54:19	17:54:59	M33	80	6	100	55	0.9	163	1.07	Mic 27 overdriven
215	5	17:56:45	17:57:26	M33	80	6	100	54	1.1	201	1.066	
216	6	17:59:14	17:59:59	M33	80	6	100	52.9	0.8	221	1.071	
217	7	18:01:43	18:02:30	M13	95-0	0	100	52.7	1.3	302	1.075	Stop 950' past main array
218	8	18:04:20	18:05:05	M13	95-0	0	100	53.1	1.5	332	1.074	Stop 980' past main array
219	9	18:07:13	18:07:49	M1	110	0	100	55	0.9	330	1.074	
220	10	18:09:27	18:10:04	M1	110	0	100	55.2	1.4	138	1.072	
221	11	18:11:42	18:12:14	M7	110	0	100	58.6	0.6	155	1.061	
222	12	18:14:06	18:14:44	M7	110	0	100	63.2	0.4	167	1.055	
223	13	18:16:54	18:17:32	M14	95-0	0	100	54.9	1.7	96	1.073	Stop 200' short of array
224	14	18:19:34	18:20:11	M14	95-0	0	100	54	2	331	1.074	
225	15	18:22:21	18:23:04	M2	95	0	100	53.9	1.1	300	1.07	
226	16	18:24:31	18:25:13	M2	95	0	100	54	3.9	269	1.074	

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Table 39: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
227	17	18:26:42	18:27:28	M8	95	0	100	55.3	1	7	1.074	
228	18	18:29:16	18:29:58	M8	95	0	100	53.9	0.9	307	1.074	
229	19	18:31:29	18:32:17	M3	65	0	100	53.9	2	282	1.073	
230	20	18:33:50	18:34:42	M3	65	0	100	53.9	3.4	311	1.072	O/D 22
231	21	18:36:04	18:36:53	M9	65	0	100	55	1.8	267	1.072	O/D 2,3,4,5,6
232	22	18:38:21	18:39:12	M9	65	0	100	53.5	2	254	1.072	
233	23	18:40:46	18:41:37	M9	65	0	100	53.9	3.5	292	1.072	
234	24	18:43:30	18:44:09	M26	80	3	100	53.7	2.1	305	1.073	
235	25	18:45:40	18:46:22	M26	80	3	100	53.3	3.8	255	1.074	
236	26	18:47:49	18:48:31	M27	80	3	100	54.4	2.5	293	1.072	
237	27	18:50:02	18:50:45	M27	80	3	100	55.1	1.6	322	1.07	
238	28	18:52:35	18:53:07	M15	95	0	100	55.5	2.1	316	1.07	
239	29	18:55:11	18:55:45	M15	95	0	100	53.8	3.6	224	1.072	
240	30	18:57:56	18:58:28	M16	110	0	100	55.1	2.9	256	1.071	
241	31	19:00:47	19:01:16	M16	110	0	100	54.6	3.7	302	1.071	
242	32	19:03:41	19:04:13	M16	110	0	100	55.7	3.5	252	1.069	2g pull up 0.2 push over
243	33	19:06:52	19:07:22	L4	110	0	100	59.3	2.3	203	1.06	
916		19:15:57	19:16:56	AMB								

Times are UTC (LOCAL: 0643, UTC 1343)

Table 40: Flight 312 Test Card, 11/8/2014, EH-60L, Amedee, 4000 Feet.

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	WS Kts	WH °	Dens kg/m^3	Comments
917		14:40:07	14:41:06	AMB				43.4	2.2	102	1.095	
244	1	15:11:48	15:13:07	L8	50	0	100.5	44.1	3.1	113	1.093	Army Flight 366
245	2	15:15:03	15:16:24	L8	50	0	100.5	44.7	3.2	110	1.092	
246	3	15:18:26	15:19:44	L8	50	0	100.5	45	3.3	110	1.091	
247	4	15:22:03	15:23:22	L16	50	0	96.5	45.3	3.7	106	1.091	
248	5	15:25:40	15:26:58	L16	50	0	96.5	45.1	3.4	101	1.091	
249	6	15:29:03	15:30:23	L16	50	0	96.5	44.8	2.9	113	1.092	
250	7	15:32:57	15:34:03	L7	65	0	100.5	45	2.6	107	1.091	
251	8	15:36:24	15:37:28	L7	65	0	100.5	43.4	3.7	94	1.095	
252	9	15:39:37	15:40:41	L7	65	0	100.5	44.2	2.8	104	1.093	
253	10	15:42:47	15:43:51	L15	65	0	96.5	44.2	2.9	105	1.093	
254	11	15:45:55	15:47:00	L15	65	0	96.5	42.8	3.4	94	1.097	
255	12	15:48:58	15:50:02	L15	65	0	96.5	43.7	3.4	80	1.093	
256	13	15:52:14	15:53:09	L6	80	0	100.5	43.1	3.8	82	1.094	
257	14	15:55:10	15:56:05	L6	80	0	100.5	44.6	4.2	85	1.093	
258	15	15:58:10	15:59:04	L6	80	0	100.5	44.3	3.9	85	1.093	
259	16	16:01:10	16:02:08	L14	80	0	96.5	45	3.9	81	1.091	
260	17	16:04:15	16:05:08	L14	80	0	96.5	44.5	3.8	84	1.093	
261	18	16:07:17	16:08:13	L14	80	0	96.5	45.1	4	83	1.091	

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Table 40: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
262	19	16:10:18	16:11:06	L5	95	0	100.5	44.1	4.3	95	1.094	
263	20	16:13:13	16:14:01	L5	95	0	100.5	43.4	4.1	96	1.095	
264	21	16:16:07	16:16:49	L5	95	0	100.5	43.9	3.8	96	1.094	
265	22	16:19:00	16:19:46	L13	95	0	96.5	44.5	3.4	95	1.092	
266	23	16:21:54	16:22:42	L13	95	0	96.5	42.3	1.9	120	1.096	
267	24	16:24:52	16:25:40	L13	95	0	96.5	42.5	2.3	124	1.097	
268	25	16:27:57	16:28:40	L4	110	0	100.5	44.4	2.9	122	1.093	
269	26	16:30:48	16:31:28	L4	110	0	100.5	44.3	2.7	122	1.093	
270	27	16:33:32	16:34:12	L4	110	0	100.5	44.9	2.9	123	1.092	
271	28	16:36:21	16:37:16	L12	110	0	96.5	45.4	1.6	151	1.088	
272	29	16:39:28	16:40:11	L12	110	0	96.5	48.7	1	170	1.083	
273	30	16:42:22	16:43:05	L12	110	0	96.5	43.7	1.1	198	1.092	
												Refuel 268.8 gal
918		17:09:14	17:10:14	AMB				45.2	2.4	289	1.091	Army Flight 367
274	1	17:36:20	17:37:56	V7	80	0	100.5	45.4	3.7	268	1.092	Extended run, Data on 2mi
275	2	17:40:34	17:42:10	V8	75	0	98	45.2	4.1	266	1.091	Extended run, Data on 2mi
276	3	17:44:29	17:45:32	V9	125	0	100.5	45.8	3.3	290	1.087	Extended run, Data on 2mi
277	4	17:47:59	17:49:07	V10	118	0	98	45.7	4.3	250	1.09	Extended run, Data on 2mi
278	5	17:51:12	17:51:53	V11	80	-6	100.5	46.3	2.9	260	1.089	OD 24

Continued on next page

Table 40: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	WS Kts	WH °	Dens kg/m^3	Comments
279	6	17:54:09	17:54:51	V12	75	-6	98	46.3	3.7	262	1.09	
280	7	17:56:51	17:57:38	V7	80	0	100.5	46.5	3.6	265	1.09	
281	8	17:59:39	18:00:25	V8	75	0	98	46.5	3.6	264	1.088	
282	9	18:02:36	18:03:07	V9	125	0	100.5	46.7	3.8	263	1.089	
283	10	18:05:18	18:05:50	V10	118	0	98	48.6	2.6	240	1.086	
284	11	18:07:46	18:08:26	V11	80	-6	100.5	47.5	2.7	248	1.086	
285	12	18:10:37	18:11:17	V12	76	-6	98	47	3.7	242	1.086	
286	13	18:13:14	18:13:59	V7	80	0	100.5	48.3	2.4	251	1.085	
287	14	18:15:56	18:16:44	V8	76	0	98	48.2	3	256	1.085	
288	15	18:18:46	18:19:16	V9	125	0	100.5	49	2.5	270	1.083	
289	16	18:21:24	18:21:56	V10	117	0	98	48.5	3.2	276	1.084	
290	17	18:23:56	18:24:34	V11	80	-6	100.5	48.4	2.6	274	1.084	
291	18	18:26:39	18:27:19	V12	75	-6	98	48.9	2.9	283	1.084	
292	19	18:29:09	18:29:54	V7	80	0	100.5	49.3	2.4	276	1.083	
293	20	18:31:57	18:32:44	V8	75	0	98	49.4	2.7	252	1.083	
294	21	18:34:49	18:35:18	V9	125	0	100.5	50	2.9	271	1.081	
295	22	18:37:30	18:38:04	V10	117	0	98	49.9	3	241	1.081	
296	23	18:40:15	18:40:54	V11	80	-6	100.5	50.1	3.4	264	1.082	
297	24	18:43:09	18:43:51	V12	75	-6	98	51.1	3.3	231	1.078	

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Table 40: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
298	25	18:45:53	18:46:36	V7	80	0	100.5	50.6	3.9	253	1.08	
299	26	18:48:39	18:49:27	V8	75	0	99	51.7	1.9	283	1.078	
300	27	18:51:03	18:52:04	V9	125	0	100.5	51.2	2.4	241	1.077	
301	28	18:54:09	18:54:42	V10	117	0	99	52.9	2.5	236	1.075	
302	29	18:56:53	18:57:32	V11	80	-6	100.5	51.9	3	269	1.075	
303	30	18:59:42	19:00:23	V12	75	-6	99	52.2	2.2	247	1.075	
304	31	19:02:17	19:03:01	V7	80	0	100.5	52.3	2.9	287	1.076	
305	32	19:05:00	19:05:49	V8	75	0	99	52.2	3.7	256	1.078	
306	33	19:07:50	19:08:22	V9	125	0	100.5	52.5	2.7	238	1.074	Slightly slow @2k' marker
307	34	19:10:33	19:11:08	V10	117	0	99	52.7	2.5	260	1.074	
308	35	19:13:06	19:13:45	V11	80	-6	100.5	52.7	3.3	284	1.075	
309	36	19:15:56	19:16:38	V12	75	-6	99	53.3	4.4	310	1.075	
310	37	19:18:41	19:19:21	V7	80	0	100.5	55.6	1.1	253	1.07	
311	38	19:21:17	19:21:58	V8	75	0	99	54	2.2	289	1.076	
312	39	19:24:04	19:24:34	V9	125	0	100.5	53.6	1.9	253	1.072	
313	40	19:26:39	19:27:12	V10	118	0	99	53.1	4.9	288	1.075	
314	41	19:29:13	19:29:51	V11	80	-6	100.5	54.1	1.4	303	1.073	
315	42	19:31:57	19:32:37	V12	75	-6	99	55.4	1.6	245	1.069	
316	43	19:34:36	19:35:16	V7	80	0	100.5	55.9	1.5	244	1.071	

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Table 40: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
317	44	19:37:07	19:37:49	V8	75	0	99	54.3	2.1	275	1.072	
318	45	19:39:50	19:40:17	V9	125	0	100.5	55.2	3	289	1.07	
319	46	19:42:18	19:42:48	V10	118	0	99	54.4	2.9	301	1.072	
320	47	19:44:39	19:45:15	V11	80	-6	100.5	55.5	1.2	273	1.069	
321	48	19:47:14	19:47:55	V12	75	-6	99	55	1.9	322	1.072	

Times are UTC (LOCAL: 1038, UTC 1838)

Table 41: Flight 315 Test Card, 11/11/2014, EH-60L, Amedee, 4000 Feet.

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
390	1	14:59:09	14:59:48	L4	110	0	100.5	32.0	1.6	265	1.107	Army Flight 370
												Pickup on road by array
391	2	15:01:54	15:02:39	A16	65	-6	100.5	32.0	2.2	256	1.107	Gen on High All Day
392	3	15:04:35	15:05:19	A16	65	-6	100.5	32.0	2.5	262	1.107	
393	4	15:07:06	15:07:50	A16	65	-6	100.5	32.1	2.4	254	1.107	
394	5	15:09:44	15:10:29	A20	65	-6	96.5	32.0	2.4	242	1.107	
395	6	15:12:26	15:13:12	A20	65	-6	96.5	32.3	1.6	261	1.106	
396	7	15:15:14	15:15:59	A20	65	-6	96.5	32.3	1.8	250	1.106	
397	8	15:18:40	15:19:23	A17	65	-9	100.5	32.4	2.2	254	1.107	
398	9	15:21:37	15:22:22	A17	65	-9	100.5	32.7	2.4	248	1.106	
399	10	15:24:32	15:25:16	A17	65	-9	100.5	33.0	2.2	254	1.105	
400	11	15:27:24	15:28:06	A21	65	-9	96.5	33.0	2.1	258	1.105	
401	12	15:30:21	15:31:05	A21	65	-9	96.5	33.3	1.6	256	1.104	
402	13	15:33:13	15:33:56	A21	65	-9	96.5	33.7	1.4	265	1.103	
403	14	15:36:20	15:37:03	A18	65	-12	100.5	33.6	1.6	281	1.102	
404	15	15:39:07	15:39:51	A18	65	-12	100.5	32.6	1.7	282	1.103	
405	16	15:41:48	15:42:33	A18	65	-12	100.5	34.0	1.2	281	1.103	
406	17	15:44:47	15:45:30	A22	65	-12	96.5	34.0	1.4	267	1.102	97.5% RPM
407	18	15:47:48	15:48:32	A22	65	-12	96.5	34.2	1.1	254	1.102	

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Table 41: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	WS Kts	WH °	Dens kg/m^3	Comments
408	19	15:50:52	15:51:35	A22	65	-12	96.5	35.0	0.9	265	1.101	
409	20	15:53:49	15:54:29	A7	80	-3	100.5	33.7	1.5	278	1.101	
410	21	15:56:25	15:57:02	A7	80	-3	100.5	33.9	1.9	272	1.103	
411	22	15:59:04	15:59:42	A7	80	-3	100.5	35.0	2.2	280	1.101	
412	23	16:01:50	16:02:27	A11	80	-3	96.5	34.3	1.8	268	1.102	
413	24	16:04:41	16:05:19	A11	80	-3	96.5	34.4	1.2	287	1.102	
414	25	16:07:29	16:08:07	A11	80	-3	96.5	34.2	1.6	263	1.101	
415	26	16:10:21	16:10:59	A8	80	-6	100.5	33.7	1.3	286	1.100	
416	27	16:13:04	16:13:42	A8	80	-6	100.5	34.9	1.3	287	1.102	
417	28	16:15:51	16:16:29	A8	80	-6	100.5	34.5	1.4	280	1.099	
418	29	16:18:44	16:19:22	A12	80	-6	96.5	35.2	1.2	287	1.100	
419	30	16:21:36	16:22:14	A12	80	-6	96.5	33.3	1.6	249	1.104	
420	31	16:24:28	16:25:06	A12	80	-6	96.5	34.3	1.4	282	1.101	
421	32	16:27:24	16:28:04	A9	80	-9	100.5	32.5	1.6	251	1.106	
422	33	16:30:29	16:31:07	A9	80	-9	100.5	34.8	1.3	274	1.103	
423	34	16:33:26	16:34:04	A9	80	-9	100.5	33.5	1.6	270	1.105	
424	35	16:36:25	16:37:03	A13	80	-9	96.5	33.6	1.6	259	1.103	
425	36	16:39:20	16:39:58	A13	80	-9	96.5	34.4	1.4	257	1.102	
426	37	16:42:20	16:42:58	A13	80	-9	96.5	35.6	0.7	258	1.101	

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Table 41: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
427	38	16:45:18	16:45:56	L4	110	0	100.5	35.8	0.4	286	1.099	
												Refuel 284.7gal
428	1	17:31:39	17:32:17	L4	110	0	100.5					Army Flight 371
												Balloon down for repair
429	2	17:34:53	17:35:33	A10	80	-12	100.5					Balloon going back up
430	3	17:38:00	17:38:38	A10	80	-12	100.5					Balloon going back up
431	4	17:41:00	17:41:39	A10	80	-12	100.5					Balloon going back up
432	5	17:44:03	17:44:42	A14	80	-12	96.5					Balloon going back up
433	6	17:47:10	17:47:48	A14	80	-12	96.5	38.5	1.5	226	1.091	
434	7	17:50:13	17:50:51	A14	80	-12	96.5	44.7	0.7	250	1.089	
435	8	17:53:13	17:53:47	A3	95	-3	100.5	45.3	0.7	200	1.076	
436	9	17:55:57	17:55:57	A3	95	-3	100.5	44.6	1.4	195	1.083	
437	10	17:58:44	17:59:18	A3	95	-3	100.5	47.7	0.6	182	1.079	
438	11	18:01:35	18:02:10	A5	95	-3	96.5	44.2	1.1	232	1.085	
439	12	18:04:29	18:05:04	A5	95	-3	96.5	41.4	2.8	205	1.086	
440	13	18:07:21	18:07:55	A5	95	-3	96.5	40.5	1.8	234	1.089	
441	14	18:10:12	18:10:46	A4	95	-6	100.5	42.4	2.0	185	1.082	
442	15	18:13:07	18:13:42	A4	95	-6	100.5	42.6	3.3	198	1.082	
443	16	18:15:57	18:16:31	A4	95	-6	100.5	44.0	0.6	281	1.080	

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Table 41: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA	N_R	Balloon				Comments
						°	%	T °F	WS Kts	WH °	Dens kg/m^3	
444	17	18:18:54	18:19:30	A6	95	-6	96.5	46.6	0.6	155	1.077	
445	18	18:21:54	18:22:30	A6	95	-6	96.5	40.3	1.4	290	1.087	
446	19	18:24:52	18:25:26	A6	95	-6	96.5	45.4	1.4	218	1.080	
447	20	18:28:23	18:28:56	A35	95	-9	100.5	43.9	2.2	225	1.080	
448	21	18:31:14	18:31:48	A35	95	-9	100.5	43.8	1.8	265	1.077	
449	22	18:34:14	18:34:49	A35	95	-9	100.5	44.2	1.7	165	1.082	
450	23	18:37:14	18:37:48	A36	95	-9	96.5	44.0	1.8	150	1.078	
451	24	18:40:13	18:40:45	A36	95	-9	96.5	44.5	1.3	248	1.079	
452	25	18:43:14	18:43:47	A36	95	-9	96.5	50.5	0.4	105	1.068	On border of Auto-rotation
453	26	18:46:22	18:46:53	A1	110	-3	100.5	45.4	1.7	126	1.074	
454	27	18:49:09	18:49:40	A1	110	-3	100.5	45.6	1.4	246	1.074	
455	28	18:52:00	18:52:28	A1	110	-3	100.5	45.4	2.7	314	1.074	
456	29	18:54:59	18:55:28	A37	110	-6	100.5	45.9	3.5	206	1.078	
457	30	18:57:49	18:58:19	A37	110	-6	100.5	44.4	4.3	182	1.083	
458	31	19:00:37	19:01:06	A37	110	-6	100.5	47.3	1.3	200	1.074	
459	32	19:03:10	19:03:47	A31	80	3	100.5	45.7	3.0	147	1.081	
460	33	19:05:33	19:06:13	A31	80	3	100.5	44.4	2.6	152	1.080	
461	34	19:07:53	19:08:34	A31	80	3	100.5	48.1	1.6	136	1.069	
462	35	19:10:16	19:10:56	A32	80	3	96.5	47.9	1.3	129	1.070	Speed variable

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Table 41: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
463	36	19:12:35	19:13:16	A32	80	3	96.5	48.3	0.4	333	1.069	Speed variable
464	37	19:14:58	19:15:37	A32	80	3	96.5	49.3	0.5	312	1.072	Speed variable
465	38	19:17:21	19:17:58	A33	80	6	100.5	43.5	2.0	320	1.080	
466	39	19:19:30	19:20:07	A33	80	6	100.5	44.3	2.5	287	1.080	
467	40	19:21:37	19:22:17	A33	80	6	100.5	46.3	2.8	182	1.075	
468	41	19:24:02	19:24:40	A34	80	6	96.5	48.8	2.2	205	1.072	
469	42	19:26:13	19:26:52	A34	80	6	96.5	47.5	4.1	205	1.073	
470	43	19:28:32	19:29:09	A34	80	6	96.5	45.0	2.4	280	1.078	
471	44	19:31:26	19:32:05	L4	110	0	100.5	44.9	3.0	283	1.080	279.9 gal added
921		19:37:10	19:38:09	AMB				45.0	2.9	243	1.078	Gen not in Eco Mode
922		19:39:07	19:40:06	AMB				44.6	4.0	302	1.080	Gen on Eco Mode

Times are UTC (LOCAL: 1038, UTC 1838)

Table 42: Flight 316 Test Card, 11/12/2014, EH-60L, Amedee, 4000 Feet.

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA	N_R	Balloon				Comments
								T	WS	WH	Dens	
						°	%	°F	Kts	°	kg/m^3	
923		14:43:51	14:44:50	AMB				32.9	7.4	134	1.109	
472	1	15:29:22	15:29:59	L4	110	0	100	31.8	7.9	140	1.112	Army Flight 372
473	2	15:32:21	15:32:55	M4	110	0	100	33.2	6.7	133	1.110	OD 28
474	3	15:34:29	15:35:06	M4	110	0	100	33.1	7.3	135	1.109	
475	4	15:36:44	15:37:27	M10	110	0	100	32.6	8.6	128	1.110	OD 22
476	5	15:38:57	15:39:33	M10	110	0	100	32.5	8.9	132	1.110	
477	6	15:41:12	15:41:50	M5	95	0	100	33.9	7.2	134	1.107	
478	7	15:43:06	15:43:44	M5	95	0	100	34.2	6.2	139	1.106	
479	8	15:44:51	15:45:28	M11	95	0	100	34.4	5.7	134	1.105	
480	9	15:47:09	15:47:47	M11	95	0	100	34.6	6.2	133	1.105	
481	10	15:49:35	15:50:19	M6	65	0	100	35.5	5.1	140	1.103	
482	11	15:51:34	15:52:14	M6	65	0	100	34.4	5.8	145	1.106	
483	12	15:53:35	15:54:17	M12	65	0	100	35.0	4.9	151	1.105	
484	13	15:55:45	15:56:25	M12	65	0	100	32.9	6.3	149	1.109	
485	14	15:58:19	15:58:48	M23	120 varies	0	100	34.7	5.7	148	1.105	
486	15	16:00:51	16:01:22	M23	120 varies	0	100	34.4	6.0	142	1.106	
487	16	16:03:18	16:03:46	M25	120 varies	0	100	35.0	4.7	128	1.104	
488	17	16:05:41	16:06:11	M25	120 varies	0	100	34.7	4.9	125	1.105	OD 1
489	18	16:08:21	16:09:09	M17	40-140	0	100	34.0	6.2	135	1.107	120 kts over array

Continued on next page

Table 42: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	WS Kts	WH °	Dens kg/m^3	Comments
490	19	16:11:32	16:12:16	M17	40-140	0	100	32.9	5.3	141	1.110	120 kts over array
491	20	16:14:28	16:15:02	M38	80	0 to 6	100	32.0	4.8	134	1.111	
492	21	16:16:22	16:17:01	M38	80	0 to 6	100	32.4	3.2	116	1.110	
493	22	16:18:23	16:18:58	M38	80	0 to 6	100	32.9	3.7	121	1.109	
494	23	16:20:21	16:20:57	M39	80	0 to 6	100	32.6	3.5	113	1.109	
495	24	16:22:40	16:23:20	M39	80	0 to 6	100	32.9	3.5	129	1.109	
496	25	16:24:58	16:25:35	M39	80	0 to 6	100	33.5	3.7	121	1.108	
497	26	16:27:31	16:27:59	M40	80 to 50	0	100	33.8	3.4	113	1.108	
498	27	16:29:32	16:30:05	M40	80 to 50	0	100	33.6	2.8	112	1.108	
499	28	16:31:49	16:32:28	M40	80 to 50	0	100	33.9	2.9	114	1.107	
500	29	16:34:04	16:34:39	M41	80 to 50	0	100	34.3	3.3	115	1.106	
501	30	16:36:11	16:34:44	M41	80 to 50	0	100	34.6	2.9	116	1.105	
502	31	16:38:38	16:39:10	M41	80 to 50	0	100	34.4	3.2	112	1.106	
503	32	16:41:17	16:41:52	M19	80 varies	0	100	34.7	2.7	124	1.105	
504	33	16:43:25	16:43:59	M19	80 varies	0	100	35.1	2.7	165	1.104	
505	34	16:45:41	16:46:15	M21	80 varies	0	100	36.0	4.2	138	1.104	
506	35	16:48:20	16:48:58	M21	80 varies	0	100	36.1	3.4	147	1.102	
507	36	16:50:55	16:51:32	M32	80	6	100	36.0	4.7	127	1.102	
508	37	16:53:01	16:53:37	M32	80	6	100	35.6	3.7	129	1.103	

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Table 42: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA	N_R	Balloon				Comments
						°	%	T °F	WS Kts	WH °	Dens kg/m^3	
509	38	16:55:20	16:55:54	M33	80	6	100	36.5	2.9	102	1.101	
510	39	16:57:47	16:58:24	M33	80	6	100	36.2	4.9	146	1.100	
511	40	17:00:33	17:01:08	M14	95-0	0	100	37.4	5.5	126	1.100	300 ft ahead of array
512	41	17:03:32	17:03:58	M14	95-0	0	100	38.1	4.8	129	1.099	300 ft ahead of array
513	42	17:06:21	17:06:48	M15	95	0	100	37.6	5.2	141	1.099	
514	43	17:08:52	17:09:23	M15	95	0	100	37.9	5.5	135	1.099	
515	44	17:11:39	17:12:07	M16	110	0	100	38.9	5.3	127	1.096	1.8g up 0.3g down
												OD 9 10 13
516	45	17:14:20	17:14:46	M16	110	0	100	38.7	6.3	146	1.096	
517	46	17:17:04	17:17:31	M16	110	0	100	38.7	6.0	136	1.096	
518	47	17:19:37	17:20:15	L4	110	0	100	38.9	5.6	129	1.096	
												Refuel 301 gal
519	1	18:00:30	18:01:10	L4	110	0	100	41.7	8.5	109	1.091	Army Flight 373
520	2	18:03:24	18:04:00	M1	110	0	100	41.2	6.5	100	1.090	
521	3	18:05:44	18:06:25	M1	110	0	100	41.4	7.3	104	1.090	
522	4	18:08:15	18:08:48	M7	110	0	100	42.0	4.9	126	1.088	
523	5	18:10:34	18:11:09	M7	110	0	100	40.9	3.1	81	1.090	
524	6	18:13:12	18:13:48	M2	95	0	100	41.1	7.0	97	1.091	
525	7	18:15:33	18:16:08	M2	95	0	100	41.0	8.4	94	1.092	Alt varied during turn

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Table 42: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
526	8	18:17:59	18:18:34	M8	95	0	100	41.2	9.4	93	1.092	
527	9	18:20:23	18:20:58	M8	95	0	100	41.5	7.2	100	1.090	
528	10	18:22:58	18:23:42	M3	65	0	100	41.6	5.5	102	1.090	OD 3 4 5 9 23 24
529	11	18:25:02	18:25:46	M3	65	0	100	42.6	6.3	124	1.088	
530	12	18:27:15	18:28:00	M3	65	0	100	42.6	7.6	121	1.088	
531	13	18:29:35	18:30:18	M9	65	0	100	42.0	7.1	96	1.090	
532	14	18:31:45	18:32:29	M9	65	0	100	42.2	7.6	114	1.090	OD 27
533	15	18:34:19	18:35:00	M26	80	3	100	42.2	8.2	133	1.089	
534	16	18:36:28	18:37:04	M26	80	3	100	41.8	5.9	100	1.090	
535	17	18:38:34	18:39:15	M27	80	3	100	41.8	7.2	111	1.088	
536	18	18:40:56	18:41:37	M27	80	3	100	42.2	6.0	86	1.089	
537	19	18:43:31	18:44:04	M10	110	0	100	42.3	6.2	134	1.089	
538	20	18:45:48	18:46:22	M10	110	0	100	42.3	7.5	113	1.090	
539	21	18:48:19	18:48:47	M23	120 varies	0	100	41.9	7.6	108	1.090	M1 Didn't Rec Gains
540	22	18:50:40	18:51:12	M23	120 varies	0	100	42.1	6.8	120	1.088	
541	23	18:52:56	18:53:29	M25	120 varies	0	100	41.5	9.8	117	1.090	
542	24	18:55:15	18:55:47	M25	120 varies	0	100	42.0	6.5	149	1.090	
543	25	18:57:43	18:58:20	M38	80	0 to 6	100	42.5	6.8	128	1.090	
544	26	19:00:10	19:00:47	M38	80	0 to 6	100	42.9	5.7	123	1.087	

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Table 42: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon				Comments
								T °F	WS Kts	WH °	Dens kg/m^3	
545	27	19:02:04	19:02:44	M38	80	0 to 6	100	42.0	6.3	122	1.088	
546	28	19:03:54	19:04:32	M39	80	0 to 6	100	42.7	6.2	130	1.087	
547	29	19:05:58	19:06:40	M39	80	0 to 6	100	41.8	6.5	81	1.090	
548	30	19:08:16	19:08:57	M39	80	0 to 6	100	42.1	5.1	78	1.088	
549	31	19:10:53	19:11:27	M40	80 to 50	0	100	43.7	4.5	96	1.085	
550	32	19:12:53	19:13:27	M40	80 to 50	0	100	42.4	5.4	101	1.086	
551	33	19:14:51	19:15:27	M40	80 to 50	0	100	42.0	6.9	86	1.086	
552	34	19:16:49	19:17:20	M41	80 to 50	0	100	42.6	6.9	99	1.088	
553	35	19:19:00	19:19:34	M41	80 to 50	0	100	42.1	5.7	94	1.086	
554	36	19:21:14	19:21:47	M41	80 to 50	0	100	43.3	5.0	119	1.086	
555	37	19:24:02	19:24:39	M18	80 varies	0	100	44.1	3.9	134	1.084	OD 21 28
556	38	19:25:58	19:26:32	M18	80 varies	0	100	42.3	6.4	112	1.087	Turn initiated 97kt
557	39	19:28:29	19:29:05	M20	80 varies	0	100	42.3	5.5	89	1.088	
558	40	19:30:43	19:31:21	M20	80 varies	0	100	43.0	4.0	65	1.085	
559	41	19:33:30	19:34:04	M22	120 varies	0	100	42.8	6.8	90	1.086	OD 20 28
560	42	19:36:19	19:36:49	M22	120 varies	0	100	42.3	7.0	106	1.086	OD 21 28
561	43	19:38:40	19:39:43	M22	120 varies	0	100	42.4	5.4	93	1.087	OD 28
562	44	19:41:16	19:41:46	M24	120 varies	0	100	43.1	3.2	58	1.085	
563	45	19:43:32	19:44:04	M24	120 varies	0	100	43.0	2.7	84	1.085	

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Table 42: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
564	46	19:44:04	19:46:38	M28	95	3	100	43.1	8.7	130	1.085	
565	47	19:48:04	19:48:41	M28	95	3	100	42.5	6.9	110	1.087	
566	48	19:50:08	19:50:45	M29	95	3	100	42.6	4.7	38	1.086	
567	49	19:52:26	19:53:02	M29	95	3	100	43.1	3.0	87	1.085	
568	50	19:54:42	19:55:15	M30	110	3	100	42.9	4.3	131	1.085	
569	51	19:57:00	19:57:35	M30	110	3	100	43.7	7.0	135	1.085	
570	52	19:59:08	19:59:46	M31	110	3	100	42.9	4.9	131	1.085	OD 5
571	53	20:01:23	20:02:00	M31	110	3	100	43.6	2.2	100	1.084	
572	54	20:03:42	20:04:18	M34	95	6	100	43.5	3.5	100	1.084	
573	55	20:05:40	20:06:16	M34	95	6	100	43.4	4.3	99	1.084	
574	56	20:07:45	20:08:17	M35	95	6	100	43.6	4.7	117	1.083	
575	57	20:10:06	20:10:45	M35	95	6	100	43.6	4.4	126	1.084	
576	58	20:12:37	20:13:15	L4	110	0	100	43.9	3.6	145	1.084	
924		20:20:07	20:21:06	AMB				43.8	4.8	95	1.083	Refuel 60gal

Times are UTC (LOCAL: 1038, UTC 1838)

Table 43: Flight 318 Test Card, 11/14/2014, EH-60L, Amedee, 4000 Feet.

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
925		13:44:26	13:45:41	AMB				43.9	5.5	307	1.082	Gen ON
926		13:47:26	13:48:25	AMB				43.9	5.5	307	1.082	Gen OFF
577	1	15:09:35	15:10:05	L4	110	0	100	44.3	7.5	314	1.081	Army Flight 375
578	2	15:12:18	15:13:50	S1	65	15	100	43.7	7.2	305	1.083	y = 240ft @ crossing
579	3	15:15:51	15:17:12	S1	65	15	100	44.3	8.7	301	1.081	y = 260ft @ crossing
580	4	15:19:07	15:20:28	S1	65	15	100	44.1	8.6	300	1.081	
581	5	15:22:02	15:22:58	S2	65	30	100	44.6	8.0	294	1.081	y = 150' @ crossing
582	6	15:24:35	15:25:28	S2	65	30	100	44.5	8.0	302	1.080	y = 119' @ crossing
583	7	15:27:11	15:28:10	S2	65	30	100	44.3	8.2	306	1.082	y = 51' @ crossing
584	8	15:29:35	15:30:49	S3	65	15	100	44.4	8.0	303	1.081	y = 289' @ crossing, OD 26
585	9	15:32:04	15:33:18	S3	65	15	100	43.5	4.8	275	1.082	y = 180'
586	10	15:34:38	15:36:13	S3	65	15	100	43.4	5.2	314	1.083	y = 250'
587	11	15:37:55	15:39:04	S3	65	15	100	43.0	3.9	306	1.084	y = 200'
588	12	15:42:00	15:43:11	S3	65	15	100	42.4	3.9	300	1.085	y = 145'
589	13	15:44:58	15:45:47	S4	65	30	100	42.5	3.3	350	1.084	y = 72'
590	14	15:47:10	15:47:57	S4	65	30	100	42.6	2.8	5	1.084	y = 54', turned 500' early
591	15	15:49:22	15:50:12	S4	65	30	100	42.6	2.7	355	1.084	y = 77'
592	16	15:51:41	15:52:48	S5	95	15	100	43.3	3.5	339	1.083	y = 38', OD 24 25
593	17	15:54:15	15:55:25	S5	95	15	100	43.4	4.0	337	1.083	y = 200'

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Table 43: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
594	18	15:56:51	15:58:03	S5	95	15	100	43.4	2.8	328	1.083	y = 20'
595	19	16:01:17	16:02:11	S6	95	30	100	43.8	4.1	339	1.082	y = 70'
												M6 Gain not recorded (126?)
596	20	16:03:19	16:04:10	S6	95	30	100	43.2	1.9	331	1.083	y = 95'
597	21	16:05:32	16:06:23	S6	95	30	100	43.4	1.9	317	1.082	y = 167'
598	22	16:07:56	16:09:07	S7	95	15	100	44.4	3.8	320	1.081	y = 290'
599	23	16:10:47	16:12:08	S7	95	15	100	44.7	4.6	324	1.081	y = 108'
600	24	16:13:48	16:15:12	S7	95	15	100	44.4	5.3	317	1.081	y = 150'
601	25	16:16:28	16:17:19	S8	95	30	100	44.1	5.3	312	1.082	y = 11'
602	26	16:18:43	16:19:34	S8	95	30	100	43.5	4.1	310	1.082	y = 60'
603	27	16:20:53	16:21:43	S8	95	30	100	43.2	2.7	304	1.082	y = 42'
604	28	16:24:04	16:24:48	M42	80	0 to 6	100	44.3	5.0	297	1.082	
605	29	16:26:47	16:27:31	M42	80	0 to 6	100	44.0	5.5	305	1.082	
606		16:29:13	16:29:56	M43	80	0	100	46.0	5.4	286	1.078	
607		16:31:07	16:31:49	M43	80	0	100	45.2	6.0	271	1.081	May not have ADS Data
608		16:33:48	16:34:30	M43	80	0	100	45.8	5.5	284	1.080	
609	32	16:43:01	16:43:50	M43	80	0	100	45.1	3.4	310	1.076	
610	33	16:44:56	16:45:38	M43	80	0	100	45.5	2.7	295	1.077	
611	34	16:46:43	16:47:40	M44	80	0	100	45.5	4.1	321	1.077	

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Table 43: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA	N_R	Balloon				Comments
								T	WS	WH	Dens	
						°	%	°F	Kts	°	kg/m^3	
612	35	16:48:45	16:49:27	M44	80	0	100	46.2	5.2	266	1.077	
613	36	16:50:57	16:51:39	M45	110	0	100	46.6	7.0	276	1.076	
614	37	16:53:35	16:54:14	M45	110	0	100	47.0	6.7	299	1.076	
615	38	16:56:25	16:57:05	M46	110	0	100	46.8	5.3	319	1.076	
616	39	16:59:00	16:59:39	M46	110	0	100	46.5	5.9	303	1.077	
617	40	17:02:02	17:02:50	M17	40-140	0	100	46.9	5.6	316	1.078	110kts over array
618	41	17:05:01	17:06:02	M17	40-140	0	100	45.9	4.2	315	1.077	110kts over array
619	42	17:08:18	17:08:59	L4	110	0	100	45.8	7.1	310	1.078	
927		17:21:49	17:22:48	AMB				46.9	6.5	274	1.076	
												Refuel 315 gal
620	1	17:54:24	17:55:03	L4	110	0	100	48.1	8.1	249	1.072	Army Flight 376
621	2	17:56:56	17:57:26	M40	80 to 50	0	100	47.6	8.8	249	1.075	
622	3	17:58:48	17:59:17	M40	80 to 50	0	100	47.8	8.0	253	1.075	OD 26
623	4	18:00:37	18:01:12	M40	80 to 50	0	100	48.7	11.3	232	1.075	
624	5	18:02:32	18:03:01	M40	80 to 50	0	100	48.3	10.6	244	1.074	
625	6	18:04:27	18:05:00	M40	80 to 50	0	100	47.8	11.0	241	1.075	
626	7	18:06:24	18:06:52	M40	80 to 50	0	100	47.7	11.4	250	1.075	
627	8	18:08:28	18:08:58	M41	80 to 50	0	100	47.9	9.5	271	1.075	
628	9	18:10:33	18:11:08	M41	80 to 50	0	100	47.9	9.4	268	1.075	OD 25

Continued on next page

Table 43: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
629	10	18:12:42	18:13:11	M41	80 to 50	0	100	48.6	8.8	265	1.073	
630	11	18:14:41	18:15:12	M41	80 to 50	0	100	47.9	6.5	261	1.074	
631	12	18:16:41	18:17:13	M41	80 to 50	0	100	47.9	10.6	250	1.074	
632	13	18:18:44	18:19:12	M41	80 to 50	0	100	48.1	10.3	261	1.075	
633	14	18:20:58	18:21:32	M38	80	0 to 6	100	48.0	7.9	243	1.075	Slow on climb
634	15	18:22:50	18:23:24	M38	80	0 to 6	100	48.3	6.6	280	1.073	OD 5
635	16	18:24:34	18:25:05	M38	80	0 to 6	100	48.5	8.0	255	1.074	
636	17	18:26:16	18:26:50	M38	80	0 to 6	100	48.3	8.4	255	1.074	
637	18	18:28:01	18:28:34	M39	80	0 to 6	100	48.2	8.1	276	1.074	
638	19	18:29:52	18:30:28	M39	80	0 to 6	100	48.3	7.4	283	1.073	
639	20	18:31:49	18:32:27	M39	80	0 to 6	100	48.6	7.9	267	1.074	
640	21	18:33:47	18:34:19	M39	80	0 to 6	100	48.4	6.8	271	1.072	
641	22	18:35:43	18:36:07	M36	110	6	100	48.9	6.0	284	1.071	
642	23	18:37:34	18:38:04	M36	110	6	100	49.0	6.4	255	1.071	
643	24	18:39:37	18:40:20	M36	110	6	100	49.0	5.4	255	1.071	
644	25	18:41:41	18:42:10	M37	110	6	100	49.0	9.4	274	1.072	OD ALL
645	26	18:43:47	18:44:17	M37	110	6	100	49.4	9.5	263	1.071	
646	27	18:45:53	18:46:26	M37	110	6	100	50.0	14.8	280	1.072	
647	28	18:48:04	18:48:45	M38	80	0 to 6	100	50.0	11.0	246	1.071	OD 9 22 23 25

Continued on next page

Table 43: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
648	29	18:52:37	18:53:07	L0	Vh	0	100	51.9	14.3	267	1.071	WB at 140' Vh = 145 OD 1
649	30	18:56:01	18:56:32	L0	Vh	0	100	50.4	14.1	250	1.071	WB at 120'
650	31	18:58:30	18:59:10	L4	110	0	100	51.0	18.2	231	1.073	WB at 75' 15-20 deg crab
651	32	19:01:14	19:01:54	L4	110	0	100	51.0	18.8	335	1.071	WB at 70' 15-20 deg crab
928		19:09:13	19:10:12	AMB					11.0			trailer met conds, OD 23 25

Times are UTC (LOCAL: 1038, UTC 1838)

Table 44: Flight 038 Test Card, 2/7/15, EH-60L, Salton Sea, 0 Feet.

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
900		13:30:20	13:31:19	AMB				60.0	5.5	65	1.216	
901		13:53:59	13:54:58	AMB				66.7	4.4	160	1.195	Army Flight 388
101	1	14:41:26	14:42:17	V7	80	0.0	100.0	65.1	3.4	226	1.199	
102	2	14:44:17	14:45:07	V8	80	0.0	100.0	65.2	3.4	219	1.199	
103	3	14:47:02	14:47:36	V9	125	0.0	100.0	65.2	3.7	223	1.199	
104	4	14:49:38	14:50:13	V10	126	0.0	100.0	65.2	2.7	251	1.199	
105	5	14:52:10	14:53:01	V11	80	-6.0	100.0	65.1	2.7	253	1.200	
106	6	14:55:02	14:55:48	V12	80	-6.0	100.0	63.8	0.6	17	1.203	
107	7	14:58:04	14:58:36	V13	134	0.0	101.0	64.0	3.2	351	1.202	
108	8	15:00:30	15:01:01	V13	134	0.0	101.0	63.9	3.8	354	1.202	
109	9	15:02:45	15:03:31	V14	80	-4.5	100.0	64.3	3.1	344	1.201	OD M 8 (1 Sample)
110	10	15:05:27	15:06:10	V15	80	-7.5	100.0	64.9	1.9	339	1.200	Crossed at 300' AGL
111	11	15:07:58	15:08:43	V7	80	0.0	100.0	64.9	1.7	348	1.200	
112	12	15:10:20	15:11:04	V8	80	0.0	100.0	65.2	2.7	14	1.200	
113	13	15:12:50	15:13:21	V9	125	0.0	100.0	65.0	1.7	351	1.199	
114	14	15:15:14	15:15:46	V10	126	0.0	100.0	65.2	2.9	25	1.199	
115	15	15:17:39	15:18:20	V11	80	-6.0	100.0	65.4	2.9	22	1.199	Crossed at 240' AGL
116	16	15:20:45	15:21:25	V12	80	-6.0	100.0	65.9	1.1	21	1.198	Crossed at 230' AGL
117	17	15:23:31	15:24:12	V14	80	-4.5	100.0	67.0	2.2	45	1.195	Crossed at 205' AGL

Continued on next page

Table 44: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon Temp °F	Balloon Speed Kts	Balloon Heading °	Balloon Density kg/m^3	Comments
118	18	15:26:11	15:26:52	V15	81	-7.5	100.0	67.5	3.2	58	1.195	Crossed at 300' AGL
902		15:31:37	15:32:36	AMB				67.6	4.7	77	1.195	
												Refuel
119	2	16:10:06	16:10:54	V7	80	0.0	100.0	69.8	2.9	72	1.189	Army Flight 389
120	3	16:12:52	16:13:40	V8	81	0.0	100.0	70.4	4.3	86	1.189	Bad point
121	4	16:17:49	16:18:35	V8	81	0.0	100.0	70.5	4.8	82	1.188	
122	5	16:20:25	16:20:58	V9	125	0.0	100.0	71.6	3.2	94	1.188	
123	6	16:22:44	16:23:17	V10	126	0.0	100.0	70.0	4.2	94	1.189	
124	7	16:25:20	16:26:02	V11	80	-6.0	100.0	69.5	3.8	97	1.192	Crossed at 238' AGL
125	8	16:28:07	16:28:49	V12	80	-6.0	100.0	70.0	3.9	116	1.191	Crossed at 238' AGL
126	9	16:30:43	16:31:23	V7	80	0.0	100.0	69.6	3.5	99	1.191	
127	10	16:33:10	16:33:49	V8	81	0.0	100.0	69.5	3.8	96	1.191	
128	11	16:35:33	16:36:01	V9	125	0.0	100.0	69.9	3.9	95	1.190	
129	12	16:37:48	16:38:16	V10	126	0.0	100.0	68.5	5.1	96	1.193	
130	13	16:40:08	16:40:48	V11	80	-6.0	100.0	69.3	3.0	122	1.191	Crossed at 258' AGL
131	14	16:42:44	16:43:25	V12	81	-6.0	100.0	70.3	2.7	126	1.190	
132	15	16:45:25	16:46:04	V7	80	0.0	100.0	70.5	3.7	154	1.190	
133	16	16:47:59	16:48:38	V8	81	0.0	100.0	70.1	4.2	156	1.188	
134	17	16:50:29	16:50:58	V9	125	0.0	100.0	71.2	4.2	165	1.187	

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Table 44: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon Temp °F	Balloon Speed Kts	Balloon Heading °	Balloon Density kg/m^3	Comments
135	18	16:52:45	16:53:14	V10	126	0.0	100.0	70.6	3.7	172	1.188	
136	19	16:55:15	16:56:01	V11	80	-6.0	100.0	72.1	3.4	178	1.185	
137	20	16:57:55	16:58:37	V12	81	-6.0	101.0	71.6	2.6	192	1.186	
138	21	17:00:36	17:01:16	V7	80	0.0	100.0	70.8	4.5	187	1.190	
139	22	17:03:07	17:03:48	V8	81	0.0	100.0	70.5	4.7	186	1.190	
140	23	17:05:38	17:06:06	V9	125	0.0	100.0	71.0	2.4	157	1.187	
141	24	17:07:58	17:08:27	V10	127	0.0	101.0	70.2	4.7	152	1.191	3 Aircraft high alt
142	25	17:10:34	17:11:01	V10	127	0.0	101.0	70.6	4.1	150	1.190	
143	26	17:13:00	17:13:43	V11	80	-6.0	100.0	73.1	3.2	196	1.188	
144	27	17:15:37	17:16:19	V12	81	-6.0	101.0	71.3	2.8	188	1.187	
145	28	17:19:34	17:20:13	V8	81	0.0	101.0	71.0	2.0	239	1.188	
146	29	17:22:05	17:22:32	V10	127	0.0	101.0	72.1	2.5	183	1.185	
147	30	17:24:23	17:25:07	V12	80	-6.0	101.0	70.8	5.2	193	1.189	
903		17:27:27	17:28:26	AMB				70.0	6.0	223	1.191	
904		17:29:00	17:30:01	AMB				71.8	2.2	218	1.188	
												Refuel,Army Flight 390
148	1	18:03:25	18:04:10	V7	80	0.0	100.0	71.1	3.0	204	1.186	Lots of Stuff going'on
149	2	18:06:02	18:06:48	V8	80	0.0	101.0	71.2	2.2	279	1.188	Train horn +
												Small plane in area +

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Table 44: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon Temp °F	Balloon Speed Kts	Balloon Heading °	Balloon Density kg/m^3	Comments
												Jet overhead
150	3	18:08:42	18:09:14	V9	125	0.0	100.0	70.9	3.2	247	1.189	
151	4	18:11:20	18:11:50	V10	126	0.0	100.0	70.4	3.1	241	1.188	Aircraft in area
152	5	18:14:15	18:14:58	V11	80	-6.0	100.0	71.5	2.5	238	1.188	
153	6	18:16:44	18:17:28	V12	80	-6.0	101.0	72.0	3.8	230	1.186	
154	7	18:19:23	18:20:06	V7	80	0.0	100.0	72.7	2.2	300	1.185	
155	8	18:21:58	18:22:38	V8	80	0.0	101.0	73.5	1.9	276	1.182	Off Condition
156	9	18:24:22	18:25:03	V8	80	0.0	101.0	72.1	1.9	261	1.184	
157	10	18:26:52	18:27:23	V9	125	0.0	100.0	72.0	3.1	289	1.186	
158	11	18:29:13	18:29:44	V10	125	0.0	101.0	72.1	3.7	255	1.184	
159	12	18:31:56	18:32:39	V11	80	-6.0	100.0	72.0	2.9	286	1.185	ATV's on road
160	13	18:34:53	18:35:34	V12	80	-6.0	101.0	71.9	3.7	305	1.187	ATV's on road

Times are UTC (LOCAL: 0402, UTC 1202)

Table 45: Flight 039 Test Card, 2/8/15, EH-60L, Salton Sea, 0 Feet.

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
905		13:55:28	13:56:27	AMB				64.6	2.7	124	1.198	Army Flight 391
												WB: 07:47:18 - 15:14:18
201	1	14:44:35	14:45:24	V7	80	0.0	100.0					WB failure, Ants OFF
202	2	14:47:12	14:48:07	V8	80	0.0	100.0					WB failure, Ants OFF
203	3	14:50:02	14:50:35	V9	125	0.0	100.0					WB failure, Ants OFF
204	4	14:52:38	14:53:12	V10	125	0.0	100.0					WB failure, Ants OFF
205	5	14:55:11	14:55:54	V11	80	-6.0	100.0					WB failure, Ants OFF
												Crossed at 238' AGL
206	6	14:58:05	14:58:48	V12	80	-6.0	100.0					WB failure, Ants OFF
207	7	15:01:42	15:02:22	V14	80	-4.5	100.0					WB failure, Ants OFF
208	8	15:04:18	15:05:03	V15	80	-7.5	100.0					WB failure, Ants OFF
209	9	15:07:07	15:07:55	V7	80	0.0	100.0					WB failure, Ants OFF
210	10	15:10:05	15:10:53	V8	81	0.0	100.0	67.4	3.8	24	1.195	WB @150', Ants OFF
211	11	15:12:45	15:13:18	V9	125	0.0	100.0	68.2	4.0	17	1.191	WB Fixed, Ants OFF
212	12	15:15:07	15:15:40	V10	126	0.0	100.0	68.8	3.7	14	1.190	Ants OFF
213	13	15:17:49	15:18:31	V11	80	-6.0	100.0	68.9	3.4	8	1.190	Ants OFF
214	14	15:20:33	15:21:15	V12	81	-6.0	100.0	68.7	3.7	17	1.190	Ants OFF
215	15	15:23:27	15:24:12	V14	81	-4.5	100.0	68.7	4.1	16	1.190	Ants OFF
216	16	15:26:08	15:26:53	V15	81	-7.5	100.0	69.0	4.2	24	1.190	Ants OFF

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Table 45: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon Temp °F	Balloon Speed Kts	Balloon Heading °	Balloon Density kg/m^3	Comments
217	17	15:29:05	15:29:53	V7	80	0.0	100.0	69.1	4.4	27	1.190	Ants ON
218	18	15:31:46	15:32:28	V7	80	0.0	100.0	69.4	4.4	37	1.189	
219	19	15:34:12	15:34:54	V8	81	0.0	100.0	69.7	4.4	33	1.189	
220	20	15:36:50	15:37:20	V9	125	0.0	100.0	70.0	3.2	31	1.188	
221	21	15:39:28	15:39:59	V10	125	0.0	100.0	70.4	2.7	34	1.187	
222	22	15:42:04	15:42:45	V11	80	-6.0	100.0	70.4	3.0	34	1.187	
223	23	15:44:52	15:45:34	V12	80	-6.0	100.0	71.1	2.6	42	1.186	
906		15:48:16	15:49:15	AMB				72.0	2.2	52	1.184	
												Refuel, WB Timing Fixed
224	1	16:22:50	16:23:30	V7	80	0.0	100.0	75.6	0.5	94	1.181	Army Flight 392, WB@150'
225	2	16:25:42	16:26:23	V8	80	0.0	101.0	76.9	0.0	42	1.175	
226	3	16:28:17	16:28:46	V9	125	0.0	100.0	78.7	0.0	313	1.172	
227	4	16:30:43	16:31:13	V10	125	0.0	101.0	75.0	0.0	266	1.179	
228	5	16:33:08	16:33:50	V11	80	-6.0	100.0	74.4	0.6	239	1.180	
229	6	16:35:50	16:36:31	V12	80	-6.0	101.0	72.8	0.8	288	1.185	
230	7	16:38:24	16:39:05	V14	80	-4.5	101.0	71.8	1.3	253	1.185	
231	8	16:41:01	16:41:42	V15	80	-7.5	101.0	71.9	1.3	262	1.184	
232	9	16:43:34	16:44:16	V7	80	0.0	100.0	74.5	0.4	268	1.177	
233	10	16:46:13	16:46:57	V8	80	0.0	101.0	76.9	0.6	20	1.175	

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Table 45: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon Temp °F	Balloon Speed Kts	Balloon Heading °	Balloon Density kg/m^3	Comments
234	11	16:48:42	16:49:14	V9	125	0.0	100.0	71.5	1.5	269	1.187	
235	12	16:51:03	16:51:32	V10	125	0.0	101.0	71.9	1.4	170	1.183	
236	13	16:53:43	16:54:26	V11	80	-6.0	100.0	72.6	1.4	231	1.184	
237	14	16:56:36	16:57:17	V12	80	-6.0	101.0	72.0	1.6	249	1.184	
238	15	16:59:08	16:59:51	V7	80	0.0	100.0	74.0	0.8	271	1.182	
239	16	17:01:42	17:02:26	V8	80	0.0	101.0	71.0	2.6	257	1.189	
240	17	17:04:15	17:04:46	V9	125	0.0	100.0	70.9	3.1	242	1.188	Airliner overhead
241	18	17:06:41	17:07:12	V10	125	0.0	100.0	70.7	4.2	251	1.188	Airliner overhead
242	19	17:09:07	17:09:49	V11	80	-6.0	100.0	71.8	1.9	256	1.185	Airliner overhead
243	20	17:11:44	17:12:25	V12	80	-6.0	101.0	71.4	2.1	204	1.185	
244	21	17:14:17	17:15:01	V7	80	0.0	100.0	71.5	2.4	245	1.187	
245	22	17:16:53	17:17:37	V8	80	0.0	100.0	71.3	2.6	229	1.186	
246	23	17:19:35	17:20:06	V9	125	0.0	100.0	72.0	2.2	249	1.183	
247	24	17:22:05	17:22:38	V10	125	0.0	101.0	71.9	2.4	271	1.187	
248	25	17:24:34	17:25:15	V11	80	-6.0	100.0	71.8	2.5	266	1.187	
249	26	17:27:13	17:27:54	V12	80	-6.0	101.0	71.9	2.0	249	1.185	
250	27	17:29:54	17:30:37	V7	80	0.0	100.0	71.3	3.4	254	1.187	
251	28	17:32:24	17:33:08	V8	80	0.0	100.0	72.1	2.6	251	1.185	
252	29	17:35:02	17:35:33	V9	125	0.0	100.0	71.8	3.5	252	1.186	

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Table 45: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon Temp °F	Balloon Speed Kts	Balloon Heading °	Balloon Density kg/m^3	Comments
253	30	17:37:36	17:38:07	V10	125	0.0	101.0	71.9	2.8	274	1.186	
254	31	17:39:55	17:40:38	V11	80	-6.0	100.0	72.4	2.5	243	1.184	
255	32	17:42:31	17:43:16	V12	80	-6.0	101.0	72.4	3.0	274	1.185	
256	33	17:45:10	17:45:40	V10	125	0.0	101.0	74.0	1.9	244	1.182	
907		17:47:34	17:48:33	AMB				73.5	1.6	279	1.183	
												Refuel
257	1	18:19:05	18:19:50	V7	80	0.0	100.0	72.7	4.7	276	1.185	Army Flight 393
258	2	18:21:54	18:22:39	V8	80	0.0	101.0	73.2	7.5	276	1.184	
259	3	18:24:42	18:25:12	V9	125	0.0	100.0	72.3	6.4	245	1.184	
260	4	18:27:06	18:27:38	V10	125	0.0	101.0	73.7	5.4	213	1.182	
261	5	18:29:36	18:30:20	V11	80	-6.0	100.0	73.9	5.5	234	1.182	
262	6	18:32:25	18:33:11	V12	80	-6.0	101.0	73.0	4.2	257	1.183	
263	7	18:35:11	18:35:55	V14	80	-4.5	101.0	73.6	5.1	234	1.181	
264	8	18:38:06	18:38:50	V15	80	-7.5	101.0	73.2	6.0	234	1.184	
908		18:46:48	18:47:48	AMB				73.2	5.5	224	1.182	ATV's maybe in AMB

Times are UTC (LOCAL: 0402, UTC 1202)

Table 46: Flight 040 Test Card, 2/9/15, EH-60L, Salton Sea, 0 Feet.

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon T °F	Balloon WS Kts	Balloon WH °	Balloon Dens kg/m^3	Comments
909		13:55:31	13:56:30	AMB					1.8	22		Army Flight 394
301	1	14:23:25	14:24:12	V7	80	0.0	100.0	69.0	2.0	50	1.188	
302	2	14:26:11	14:26:58	V8	81	0.0	100.0	68.9	2.0	51	1.188	
303	3	14:28:54	14:29:27	V9	125	0.0	100.0	68.6	1.1	52	1.189	
304	4	14:31:24	14:31:56	V10	126	0.0	100.0	67.2	0.2	33	1.192	
305	5	14:33:56	14:34:39	V11	80	-6.0	100.0	67.6	2.0	229	1.190	
306	6	14:36:41	14:37:24	V12	81	-6.0	100.0	67.0	1.1	270	1.191	
307	7	14:39:24	14:40:07	V14	81	-4.5	100.0	66.8	0.4	191	1.193	
308	9	14:41:55	14:42:37	V15	81	-7.5	100.0	67.9	0.6	194	1.190	
309	10	14:44:31	14:45:12	V7	80	0.0	100.0	67.7	0.9	202	1.191	
310	11	14:46:58	14:47:41	V8	80 *	0.0	100 *	68.1	0.6	187	1.189	Large Truck on road
311	12	14:49:29	14:49:58	V9	125	0.0	100.0	68.1	0.2	210	1.190	Large Truck on road
312	13	14:51:48	14:52:18	V10	126	0.0	100.0	68.2	0.3	226	1.190	
313	15	14:54:14	14:54:58	V11	80	-6.0	100.0	68.4	0.3	223	1.189	
314	16	14:56:56	14:57:37	V12	81	-6.0	100.0	68.5	0.5	215	1.189	
315	17	14:59:31	15:00:15	V7	80	0.0	100.0	69.0	0.4	244	1.188	
316	18	15:02:12	15:02:59	V8	81	0.0	100.0	68.9	0.6	257	1.188	
317	19	15:04:48	15:05:20	V9	125	0.0	100.0	68.0	1.4	273	1.190	
318	20	15:07:21	15:07:53	V10	126	0.0	100.0	68.3	1.8	261	1.190	

Continued on next page

Table 46: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon Temp °F	Balloon Speed Kts	Balloon Heading °	Balloon Density kg/m^3	Comments
319	21	15:09:53	15:10:35	V11	80	-6.0	100.0	67.6	3.4	299	1.191	
320	22	15:12:34	15:13:17	V12	81	-6.0	100.0	67.6	2.7	302	1.191	
321	23	15:15:14	15:15:58	V7	80	0.0	100.0	67.6	3.4	290	1.192	
322	24	15:17:57	15:18:42	V8	81	0.0	100.0	67.6	4.2	283	1.191	
323	25	15:20:32	15:21:04	V9	125	0.0	100.0	67.8	3.4	269	1.190	
324	26	15:22:59	15:23:31	V10	126	0.0	100.0	67.6	3.4	252	1.192	
325	27	15:25:28	15:26:11	V11	80	-6.0	100.0	66.8	4.1	263	1.194	
326	28	15:28:14	15:28:58	V12	80	-6.0	100.0	66.5	3.5	269	1.195	
910		15:32:44	15:33:43	AMB				66.1	4.4	266	1.195	Refuel, Army Flight 395
327	1	16:05:32	16:06:19	V7	80	0.0	100.0	68.8	1.2	253	1.189	
328	2	16:08:26	16:09:13	V8	81	0.0	100.0	69.0	1.0	293	1.189	
329	3	16:11:14	16:11:48	V9	125	0.0	100.0	69.7	0.6	279	1.188	
330	4	16:13:58	16:14:32	V10	126	0.0	100.0	70.1	0.4	262	1.186	
331	5	16:16:38	16:17:23	V11	80	-6.0	100.0	72.3	0.6	235	1.182	
332		16:19:32	16:20:15	V12	81	-6.0	101.0	71.2	0.8	218	1.184	ADS Malfunction, redo
333	6	16:22:24	16:23:07	V12	81	-6.0	101.0	70.9	1.8	230	1.185	
334	7	16:25:05	16:25:49	V14	81	-4.5	101.0	71.8	1.4	219	1.183	
335	8	16:27:46	16:28:30	V15	81	-7.5	101.0	72.1	1.2	219	1.183	
336	9	16:30:25	16:31:07	V7	80	0.0	100.0	73.9	0.4	240	1.181	

Continued on next page

Table 46: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon Temp °F	Balloon Speed Kts	Balloon Heading °	Balloon Density kg/m^3	Comments
337	10	16:33:09	16:33:52	V8	80	0.0	101.0	74.3	0.5	233	1.179	Jet overhead
338	11	16:35:48	16:36:17	V9	125	0.0	100.0	73.6	0.6	239	1.182	Jet overhead
339	12	16:38:18	16:38:48	V10	125	0.0	101.0	72.1	1.0	230	1.183	
340	13	16:40:50	16:41:32	V11	80	-6.0	100.0	72.5	0.9	246	1.182	
341	15	16:43:32	16:44:16	V12	80	-6.0	101.0	76.2	0.1	197	1.176	
342	16	16:46:12	16:46:55	V7	80	0.0	100.0	77.5	0.4	103	1.173	
343	18	16:48:49	16:49:33	V8	80	0.0	101.0	77.1	0.1	334	1.168	Jet overhead
344	19	16:52:30	16:52:58	V9	125	0.0	100.0	79.4	0.0	242	1.166	
345	20	16:54:55	16:55:21	V10	126	0.0	101.0	76.0	0.6	170	1.168	
346	21	16:57:17	16:57:59	V11	80	-6.0	100.0	74.6	0.5	287	1.179	
347	22	16:59:51	17:00:34	V12	80	-6.0	101.0	74.8	0.6	292	1.177	Possible jet in area
348	23	17:02:43	17:03:24	V7	80	0.0	100.0	74.0	0.8	247	1.180	jet+train in area
349	24	17:05:09	17:05:53	V8	80	0.0	101.0	72.5	0.9	263	1.183	Train with Whistle
350	25	17:07:51	17:08:22	V9	125	0.0	100.0	73.3	1.9	230	1.180	
351	26	17:10:12	17:10:41	V10	125	0.0	101.0	71.8	1.9	252	1.185	
352	27	17:12:30	17:13:11	V11	80	-6.0	100.0	71.8	1.9	270	1.183	Jet in area
353	28	17:15:08	17:15:49	V12	80	-6.0	101.0	77.0	1.1	240	1.170	Jet in area
354	29	17:17:52	17:18:32	V7	80	0.0	100.0	72.1	1.1	275	1.184	Jet in area
355	30	17:20:25	17:21:11	V8	80	0.0	101.0	72.7	1.5	304	1.179	JETS in area

Continued on next page

Table 46: *continued.*

NASA Run Num	Army Run Num	Data On Time	Data Off Time	Cond Ctr	KIAS	FPA °	N_R %	Balloon Temp °F	Balloon Speed Kts	Balloon Heading °	Balloon Density kg/m^3	Comments
356	31	17:22:54	17:23:26	V9	125	0.0	100.0	73.9	1.1	248	1.179	JETS in area
357	32	17:25:20	17:25:50	V10	125	0.0	101.0	78.4	0.6	189	1.164	JETS in area, wpn fire?
358	33	17:27:32	17:28:13	V11	80	-6.0	100.0	78.9	0.8	117	1.168	JETS in area, wpn fire?
359	34	17:30:25	17:31:05	V12	80	-6.0	101.0	72.7	2.3	246	1.180	JETS in area, wpn fire?
911		17:37:26	17:39:26	AMB				73.4	2.4	256	1.180	Jets left before AMB

Times are UTC (LOCAL: 0402, UTC 1202)

Table 47: Reference List File Contents.

Column Number	Variable Name	Description	Units
1	nasa_flt	NASA flight number	fff
2	nasa_run	NASA run number	rrr
3	nasa_comb	Combined NASA number	fffrrr
4	army_flt	Army flight number	ggg
5	army_run	Army run number	hhh
6	army_comb	Combined Army number	FgggRhhh
7	date	Test day	mmddyy
8	site	Test site	
9	utc_h_start	Run start UTC hours	
10	utc_m_start	Run start UTC minutes	
11	utc_sec_start	Run start UTC seconds	
12	utc_secs_from_mid	Run start UTC seconds from mid.	sec
13	duration	Record duration	sec
14	overhead_time	Overhead time in secs from mid.	sec
15	ref_lat	Reference latitude	deg
16	ref_lon	Reference longitude	deg
17	ref_elip	Reference ellipsoid height	ft
18	test_cond	Test condition	
19	com_ias	Commanded indicated airspeed	kts
20	fpa	Commanded flight path angle	deg
21	avg_tas	Average true airspeed for run	kts
22	avg_grd_spd	Average ground speed for run	kts
23	avg_ias	Average indicated airspeed for run	kts
24	rpm	Commanded RPM	%
25	xaxis_hdg	x axis true direction	deg
26	to_gw	Take off gross weight	lbs
27	fuel_%	Fuel remaining	%
28	gw	Gross weight for run	lbs
29	balloon_temp	Balloon temperature	°F
30	balloon_ws_kts	Balloon wind speed	kts
31	balloon_wd	Balloon wind direction	deg
32	balloon_dens	Balloon density	kg/m3
33	madv	Adv. tip Mach number M_AT	
34	mu	Advance ratio μ	
35	cw	Weight coefficient	
36	Comments	Comments for run	

Table 48: Pressure Time History File Contents.

Variable Name	Description	Units
pressure.data	Acoustic pressure as measured	pascals
global.test	Test description	
global.location	Test location	
global.date	Date of test	
global.run_number	NASA combined run number	
global.noise_source	Aircraft measured	
global.mic_number	Microphone number	
x	Mic x location in rotated coordinate frame	feet
y	Mic y location in rotated coordinate frame	feet
z	Mic z location in rotated coordinate frame	feet
global.sample_rate	Samples per second of pressure data	
global.start_time	Local seconds from midnight of first sample	secs
global.number_samples	Number of data samples	

Table 49: AS350 SD1 Inflight Data File Contents.

Column Number	Variable Name	Description	Units
1	UTC_sec	UTC seconds from midnight	sec
2	Lat	GPS Latitude	deg
3	Lon	GPS Longitude	deg
4	Ellipse_hgt	GPS ellipsoid height	ft
5	x_vel	Velocity in x direction	kts
6	y_vel	Velocity in y direction	kts
7	ROC	Rate of climb	fps
8	x	x position	ft
9	y	y position	ft
10	z	z position	ft
11	Grd_spd	Ground speed derived from GPS	kts
12	FPA	Flight path angle	deg
13	Pitch	Aircraft pitch	deg
14	Roll	Aircraft roll	deg
15	True_hdg	Aircraft true heading	deg
16	Pitch_rate	Aircraft pitch rate	deg/sec
17	Roll_rate	Aircraft roll rate	deg/sec
18	Yaw_rate	Aircraft yaw rate	deg/sec
19	x_accel	Acceleration along x axis	g
20	y_accel	Acceleration along y axis	g
21	z_accel	Acceleration along z axis	g
22	Load_factor	Load factor	g
23	IAS	Indicated airspeed	kts
24	Alpha	Airspeed boom alpha	deg
25	Beta	Airspeed boom beta	deg
26	OAT	Outside air temperature	°F
27	mu	Advance ratio, μ	
28	Mrot	Hover tip Mach number, M_H	
29	Madv	Advancing tip Mach number, M_{AT}	
30	Mhe	Effective hover tip Mach numberM_{H_e}	
31	TAS	True airspeed	kts
32	Spd_of_snd	Speed of sound	fps

Table 50: EH-60L Inflight Data File Contents.

Column Number	Variable Name	Description	Units
1	Time	Data record running time starting at 0	secs
2	UTC_sec	UTC seconds from midnight	secs
3	Lat	GPS Latitude	deg
4	Lon	GPS Longitude	deg
5	Ellipse_hgt	GPS ellipsoid height	ft
6	True_hdg	Aircraft true heading	deg
7	TStatic	Boom static temperature	°F
8	spd_of_snd	Speed of sound	fps
9	Density	Density	kg/m3
10	IAS	Indicated airspeed	kts
11	CAS	Calibrated airspeed	kts
12	EAS	Equivalent airspeed	kts
13	TAS	True airspeed	kts
14	IO9	Inertial speed	kts
15	Grd_spd	Ground speed derived from GPS	kts
16	Press_Alt	Pressure altitude	ft
17	Dens_Alt	Density altitude	ft
18	Rad_Alt	Radar altitude	ft
19	ALPHA	Boom alpha	deg +nose up
20	BETA	Boom beta	deg +nose lt
21	FPA	Flight path angle	deg +up
22	ROC	Rate of climb	fps
23	BANK	Bank angle	deg +rt
24	Weight	Gross weight	lb
25	RPM	Rotor RPM re 257.891	%
26	Vtip	Hover tip velocity	fps
27	Mrot	Hover tip Mach number M_H	
28	Mfor	Aircraft forward Mach number	
29	Madv	Advancing tip Mach number M_{AT}	
30	Mu	Advance ratio μ	
31	Cw	Weight coefficient	
32	QS_ALPHA	QSAM equivalent TPP angle	deg
33	Afor	Longitudinal acceleration	g
34	Lon_cyc	Longitudinal cyclic position	% +aft
35	Lat_cyc	Lateral cyclic position	% +rt
36	Collective	Collective position	% +up
37	Pedal	Pedal position	% +rt
38	Lon_mix_in	Longitudinal cyclic mixer input	% +aft
39	Lat_mix_in	Lateral cyclic mixer input	% +rt
40	Dir_mix_in	directional mixer input	% +rt
41	Lat_pr_serv	Lateral primary servo	%

Continued on next page

Table 50: *continued.*

Column Number	Variable Name	Description	Units
42	Fwd_pr_serv	Forward primary servo	%
43	Aft_pr_serv	Aft primary servo	%
44	Lon_sas_out	Longitudinal SAS output	% +nose up
45	Lat_sas_out	Lateral SAS output	% +roll rgt
46	Dir_sas_out	Directional SAS output	% +nose rgt
47	Stab	Stabilator position	deg
48	TR_imp_ptch	Tail rotor imprest pitch	% +nose rgt
49	Eng_torque	Combined engine torque	%
50	Pitch	Aircraft pitch	deg
51	Pitch_rate	Aircraft pitch rate	deg/sec
52	Roll	Aircraft roll	deg
53	Roll_rate	Aircraft roll rate	deg/sec
54	Stat_press	Static pressure	inHg
55	Dyn_press	Dynamic pressure	inHg
56	OAT	Outside air temperature	°F

Table 51: Balloon Sonde File Contents.

Variable Name	Description	Units
RunID	NASA combined run number	
Airtemp	Air temperature	°F
Humidity	Relative humidity	%
Pressure	Static pressure	kPa
CupSpeed	Wind speed	kts
MagWindDir	Wind magnetic direction	deg
TrueWindDir	Wind true direction	deg
IRGGroundTemp	Ground temp measured with IR sensor	°F
Density	Density	kg/m^3
NumPts	Number of points in average	
AltitudeAGLFt	Altitude above ground	ft
AltitudeRefFt	Altitude above reference	ft

Table 52: Weather Sonde File Contents.

Variable Name	Description	Units
RunID	NASA combined run number	
Date	Date data acquired	yymmdd
Voltage	Battery voltage	volts
Temperature	Air temperature	°F
Humidity	Relative humidity	%
Pressure	Static pressure	kPa
NumPts	Number of points in average	
AltitudeAGLFt	Altitude above ground	ft
AltitudeRefFt	Altitude above reference	ft

Table 53: Weather Station File Contents.

Variable Name	Description	Units
Identity	Weather station number	
RunID	NASA combined run number	
Altitude	Altitude above reference	ft
Airtemp	Air temperature	°F
Humidity	Relative humidity	%
Pressure	Static pressure	kPa
CupSpeed	Wind speed	kts
MagWindDir	Wind magnetic direction	deg
TrueWindDir	Wind true direction	deg
RainfallTot	Total rainfall since deployment	in
RainfallDly	Total rainfall for that day	in
RainfallHr	Total rainfall for that hour	in
DewPoint	Dew point	°F
NumPts	Number of points in average	

Table 54: LIDAR File Contents.

Variable Name	Description	Units
RunID	NASA combined run number	
Packets	Number data packets in average	
HorizWindSpd	Horizontal wind speed	kts
HorzWindMin	Minimum horizontal wind speed	kts
HorzWindMax	Maximum horizontal wind speed	kts
HorzWindStd	Std. dev. horizontal wind speed	kts
VertWindSpd	Vertical wind speed	kts
TI	Tubulence intensity	
Airtemp	Air temperature on ground	°F
Pressure	Static pressure on ground	kPa
Humidity	Relative humidity on ground	%
AltitudeAGLFt	Altitude above ground	ft
AltitudeRefFt	Altitude above reference	ft
MagWindDir	Wind magnetic direction	deg
TrueWindDir	Wind true direction	deg

Figures

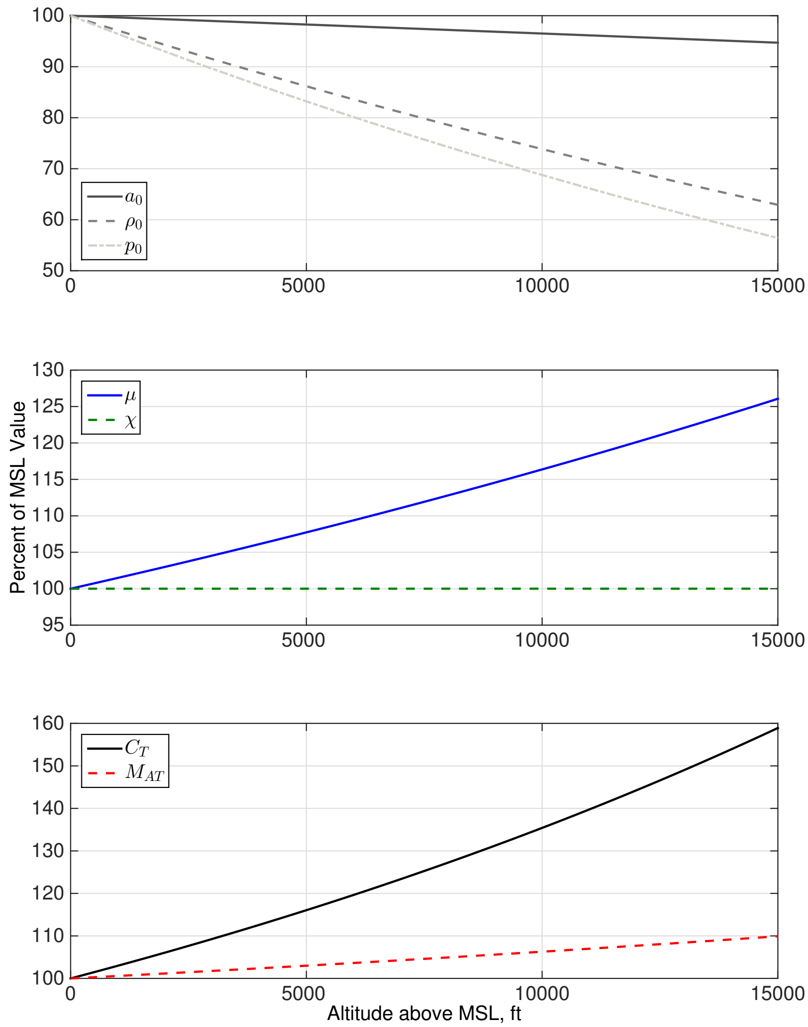
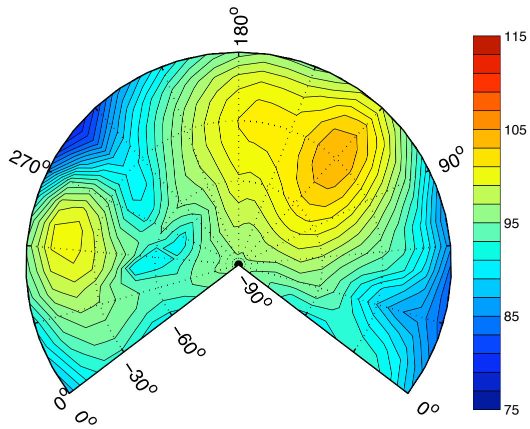
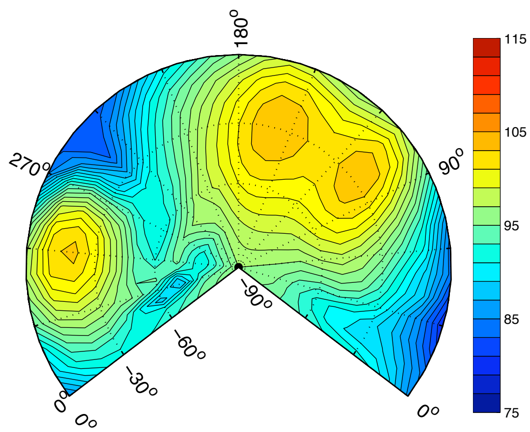


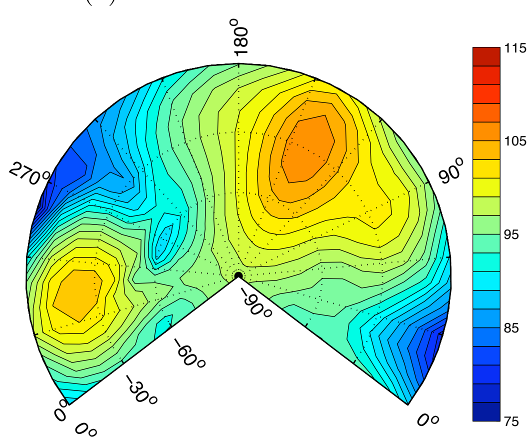
Figure 1: Change in nondimensional parameter with altitude change.



(a) Sea Level ISA conditions.



(b) 5000 feet ISA conditions.



(c) 10000 feet ISA conditions.

Figure 2: The predicted variation in Blade-Vortex Interaction noise with change in altitude for a Bell 206B in 60 KIAS, -6 FPA descending flight [2], scale is in BVISPL.

Figure 3: AS350 SD1 Aircraft (Tail Number N61HL).

Figure 4: Instrumentation panel in AS350 SD1.

Figure 5: NASA ANTS unit.

Figure 6: Airspeed boom mounted on the AS350 SD1.

(a) Front mount for airspeed boom.

(b) Back mount for airspeed boom.

Figure 7: Boom mounts.

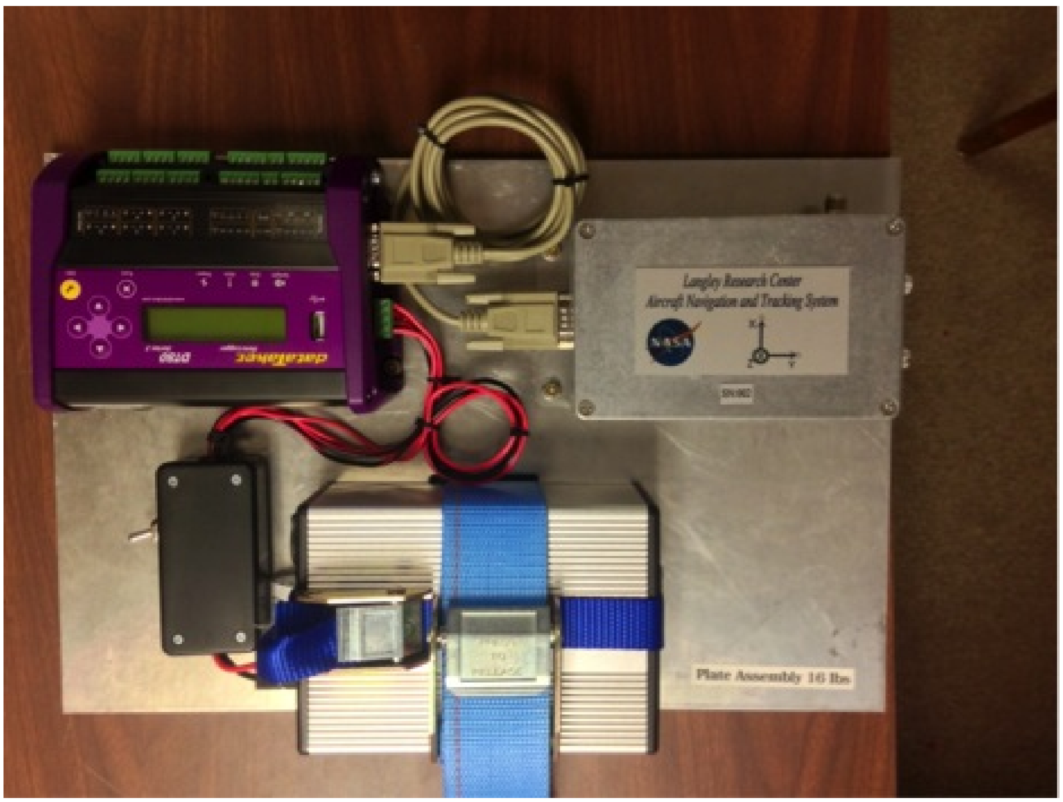


Figure 8: AS350 SD1 instrumentation pallet.

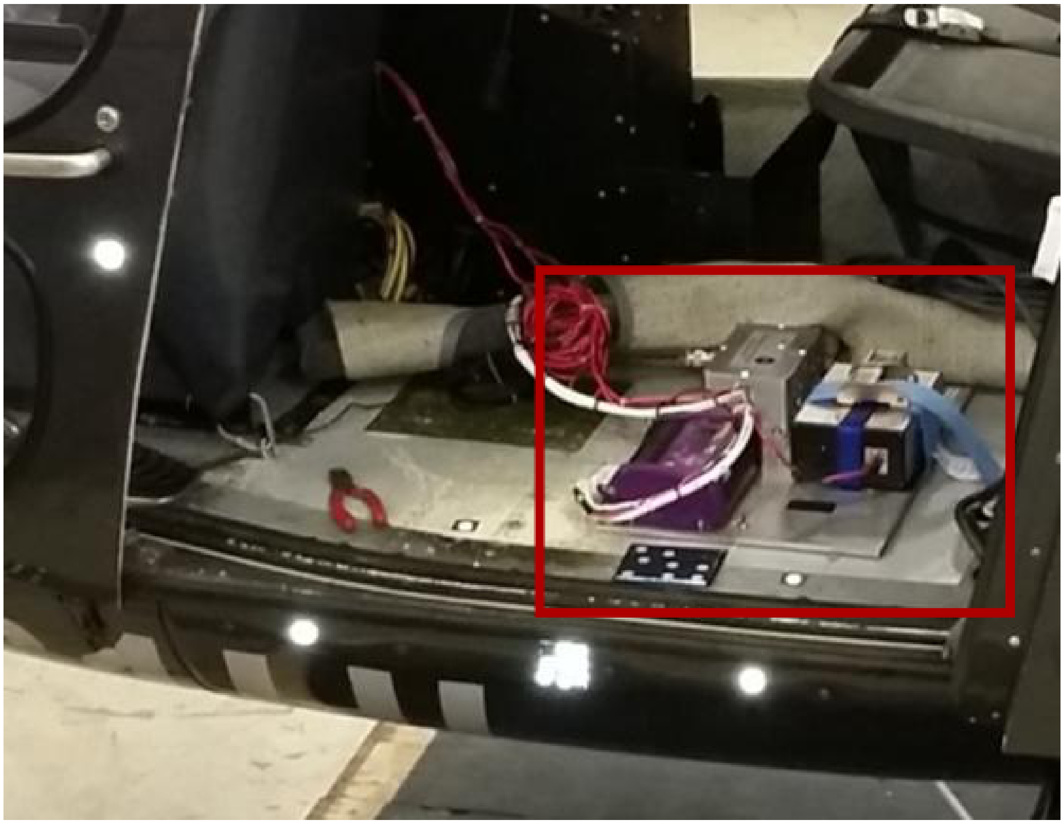


Figure 9: Instrumentation pallet installed in AS350 SD1.

Figure 10: EH-60L test aircraft (S/N 87-24657).

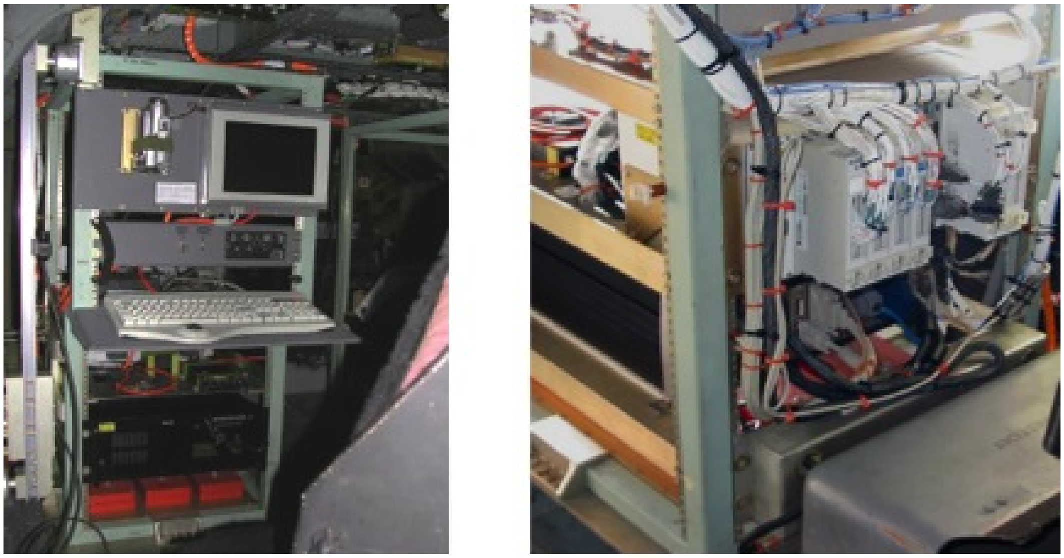


Figure 11: EH-60L Aircraft Data System computer and signal conditioner.

Figure 12: EH-60L dual LCD monitors.

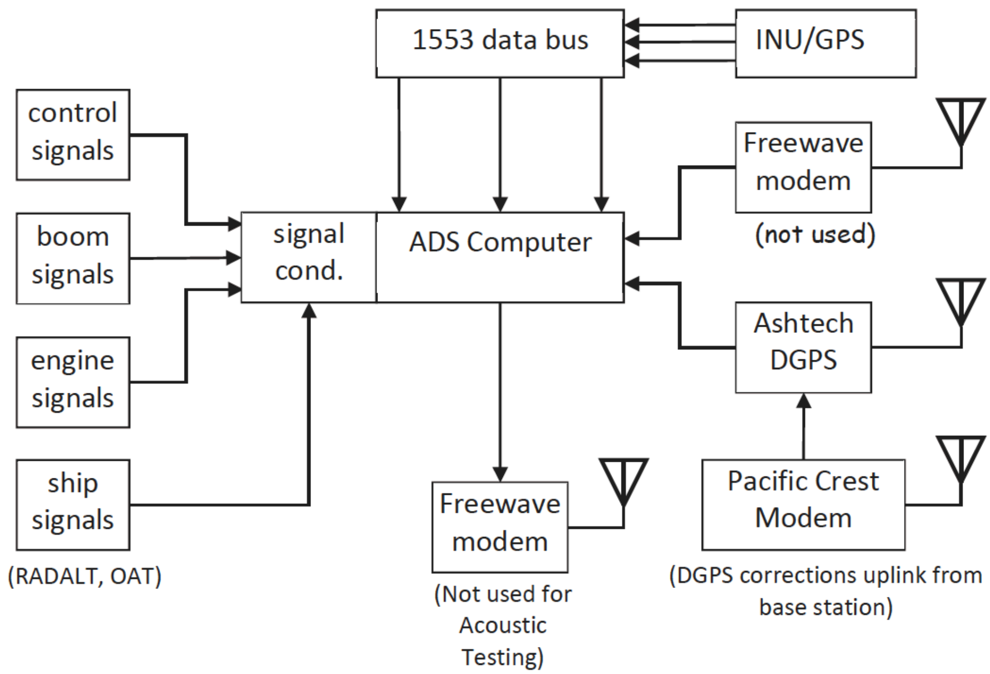


Figure 13: EH-60L aircraft Data System diagram.

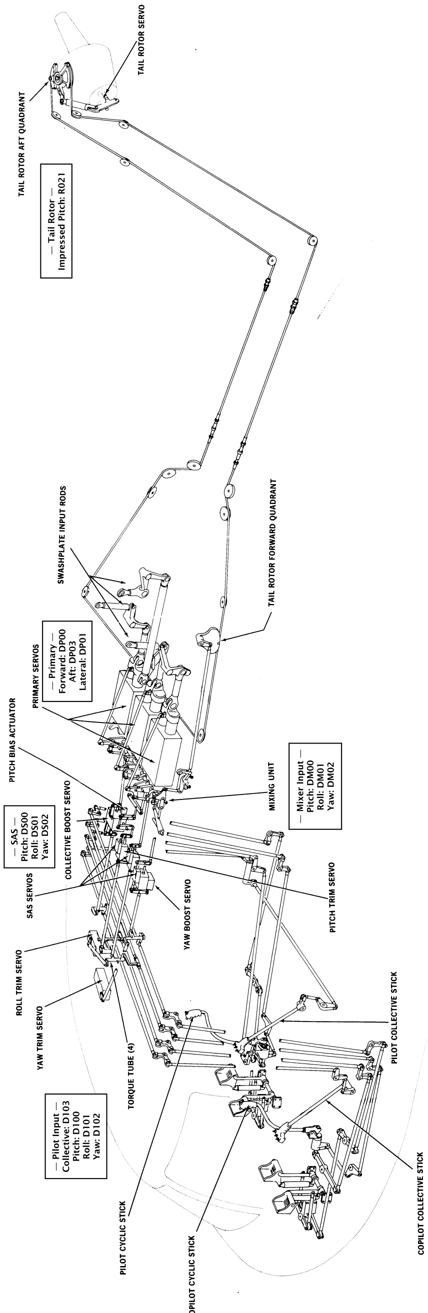


Figure 14: EH-60L aircraft control position sensor locations.

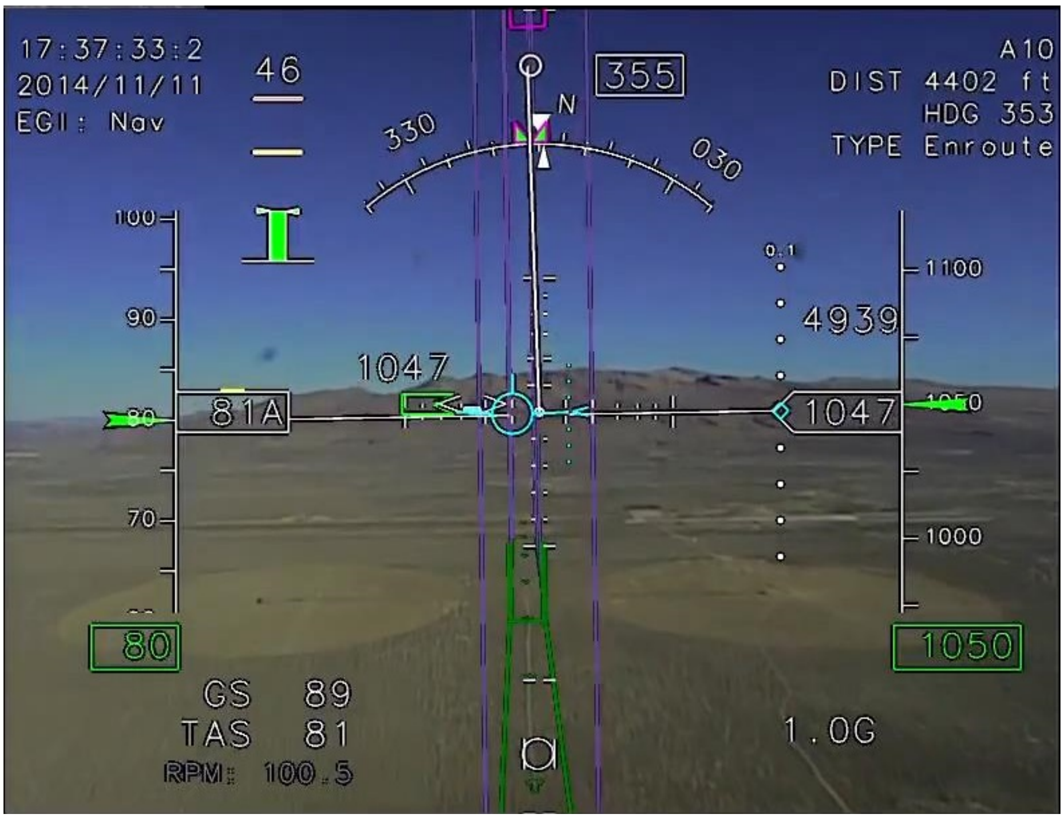


Figure 15: EH-60L guidance display.

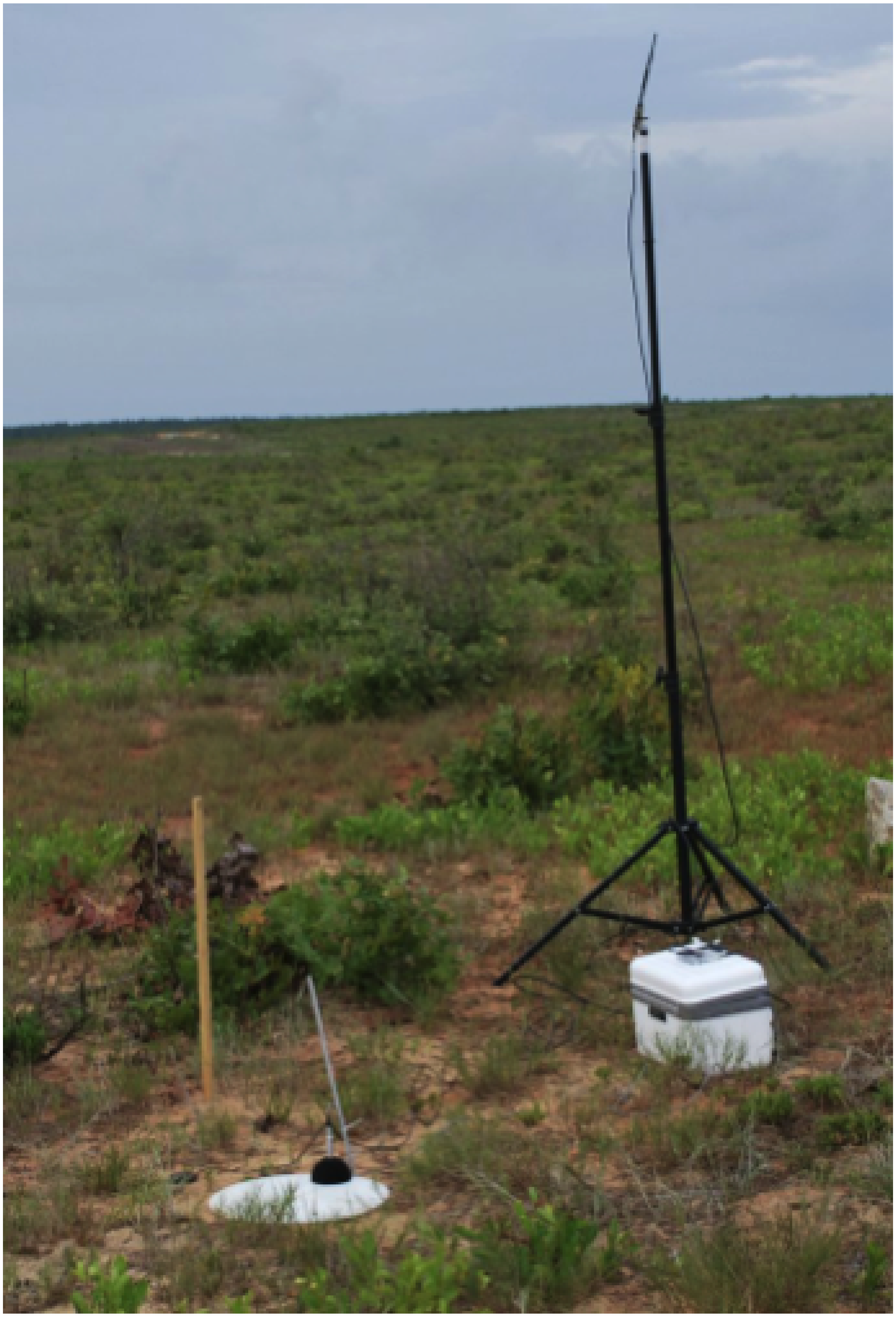


Figure 16: Wireless Acoustic Measurement System.

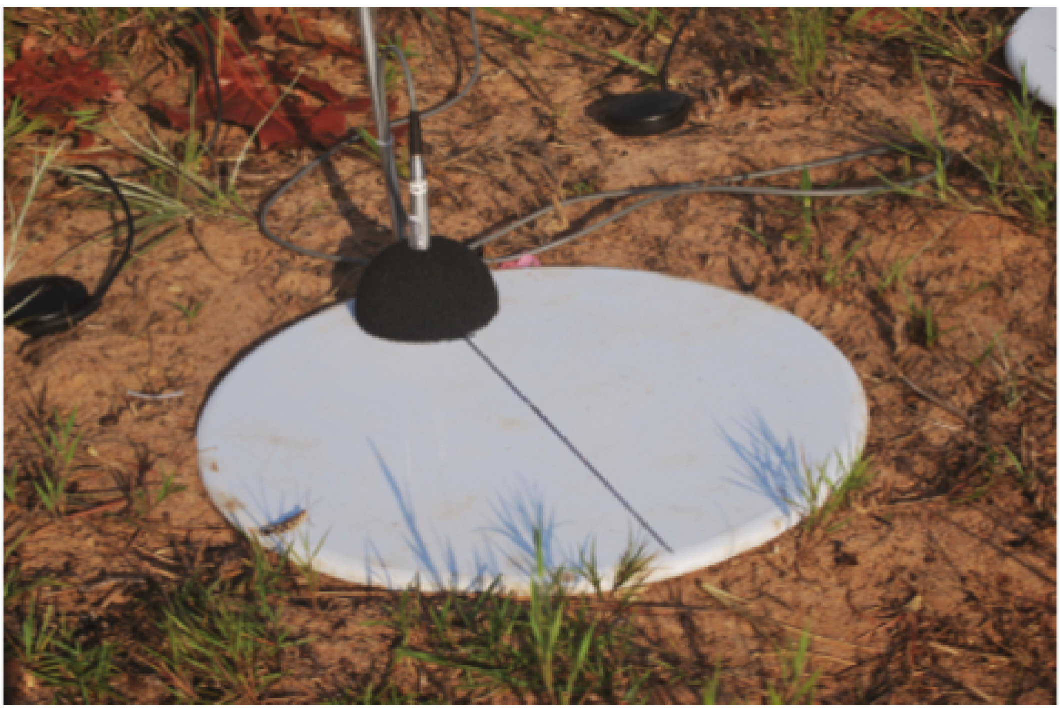


Figure 17: Microphone inverted over groundboard.

Figure 18: Tethered weather balloon with weather sonde.

Figure 19: Temperature sensors being mounted on balloon tether.

Figure 20: ZephIR 300 portable LIDAR system.

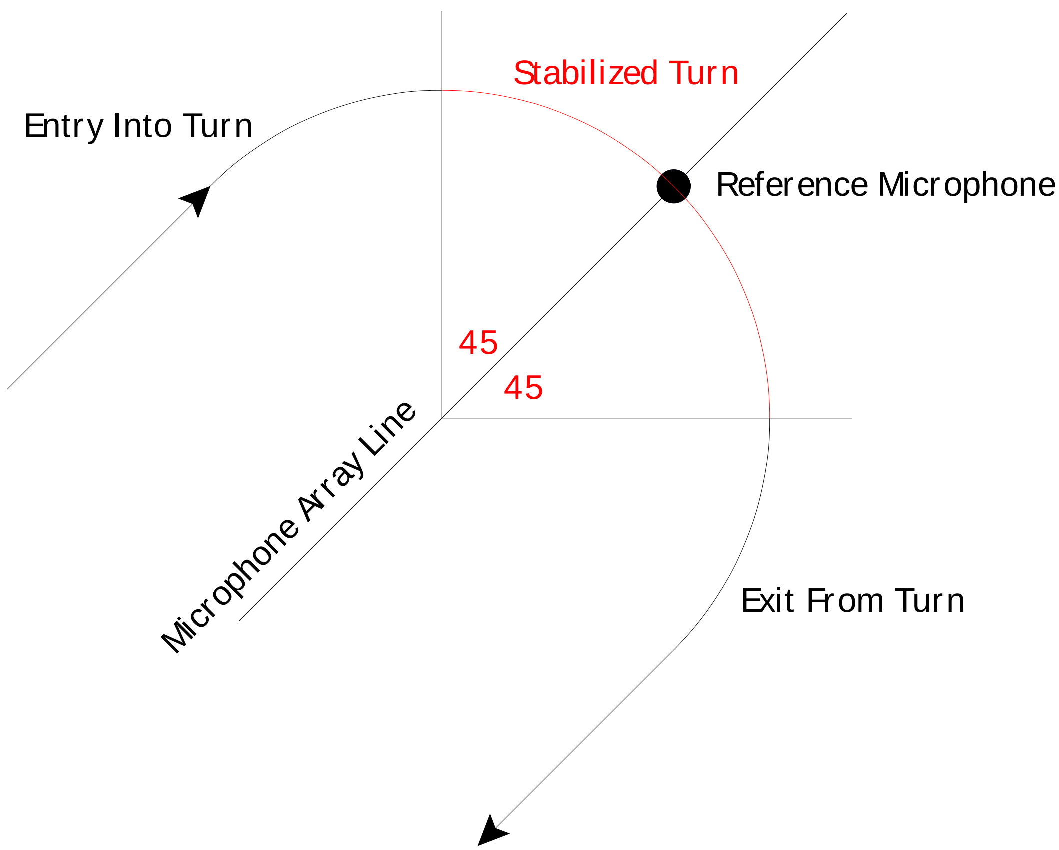


Figure 21: Steady turn test technique diagram.

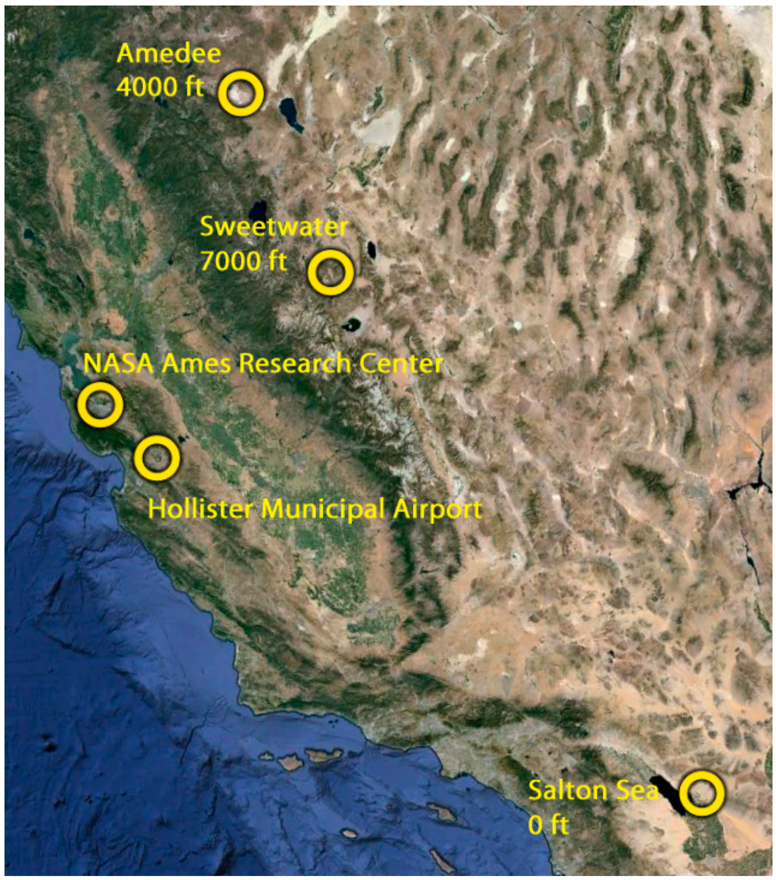


Figure 22: Overview of testing sites.

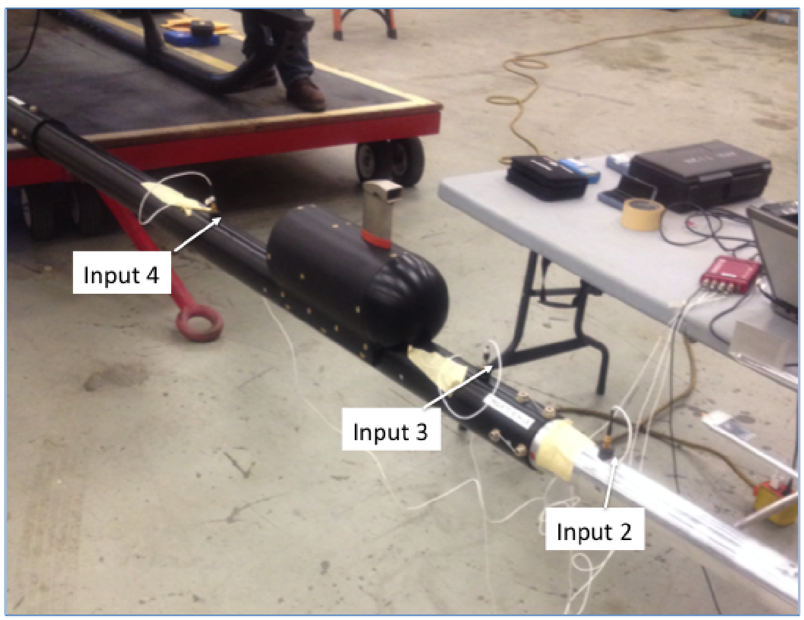


Figure 23: AS350 SD1 boom instrumented for rap test.

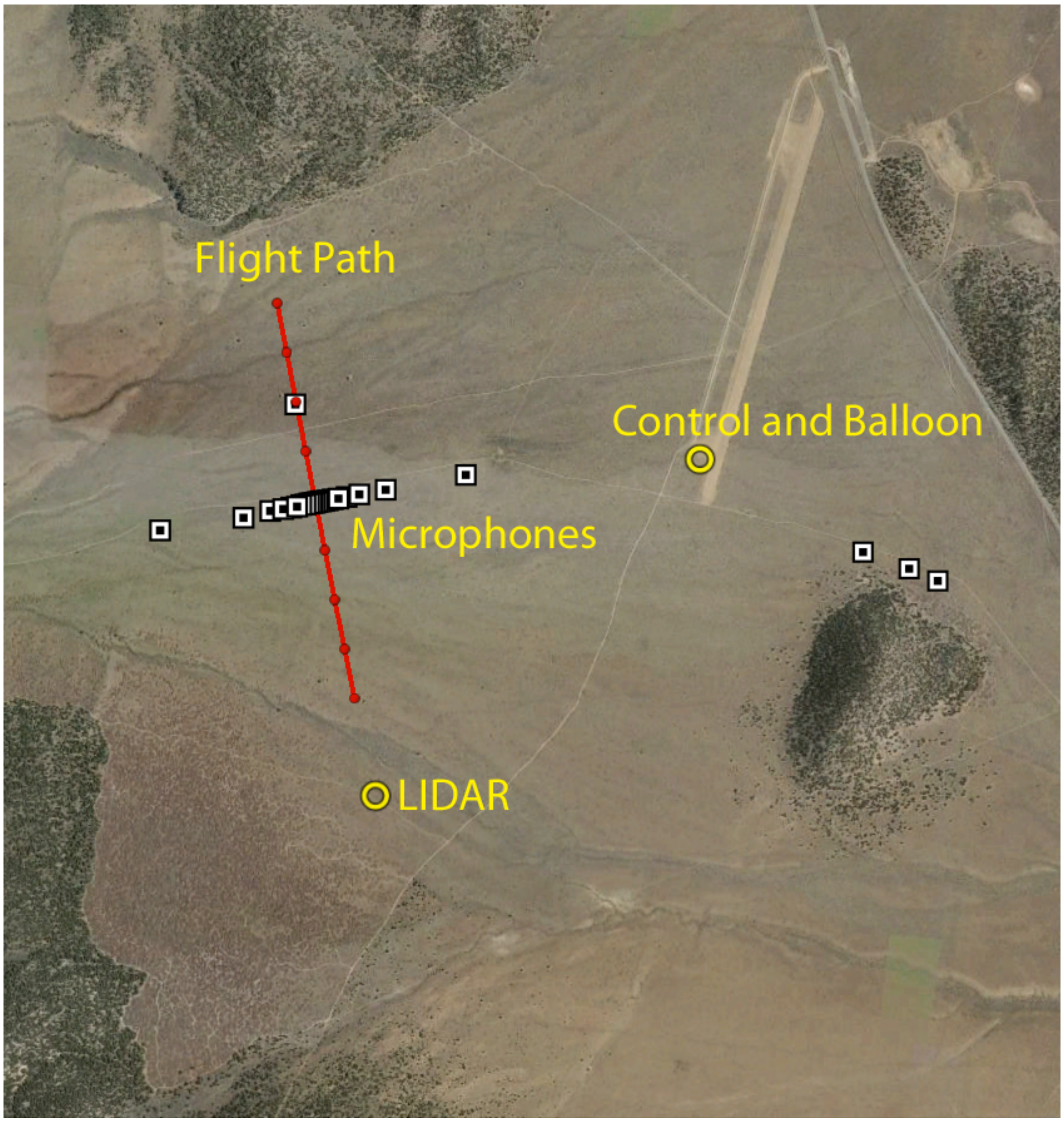


Figure 24: Sweetwater test site.

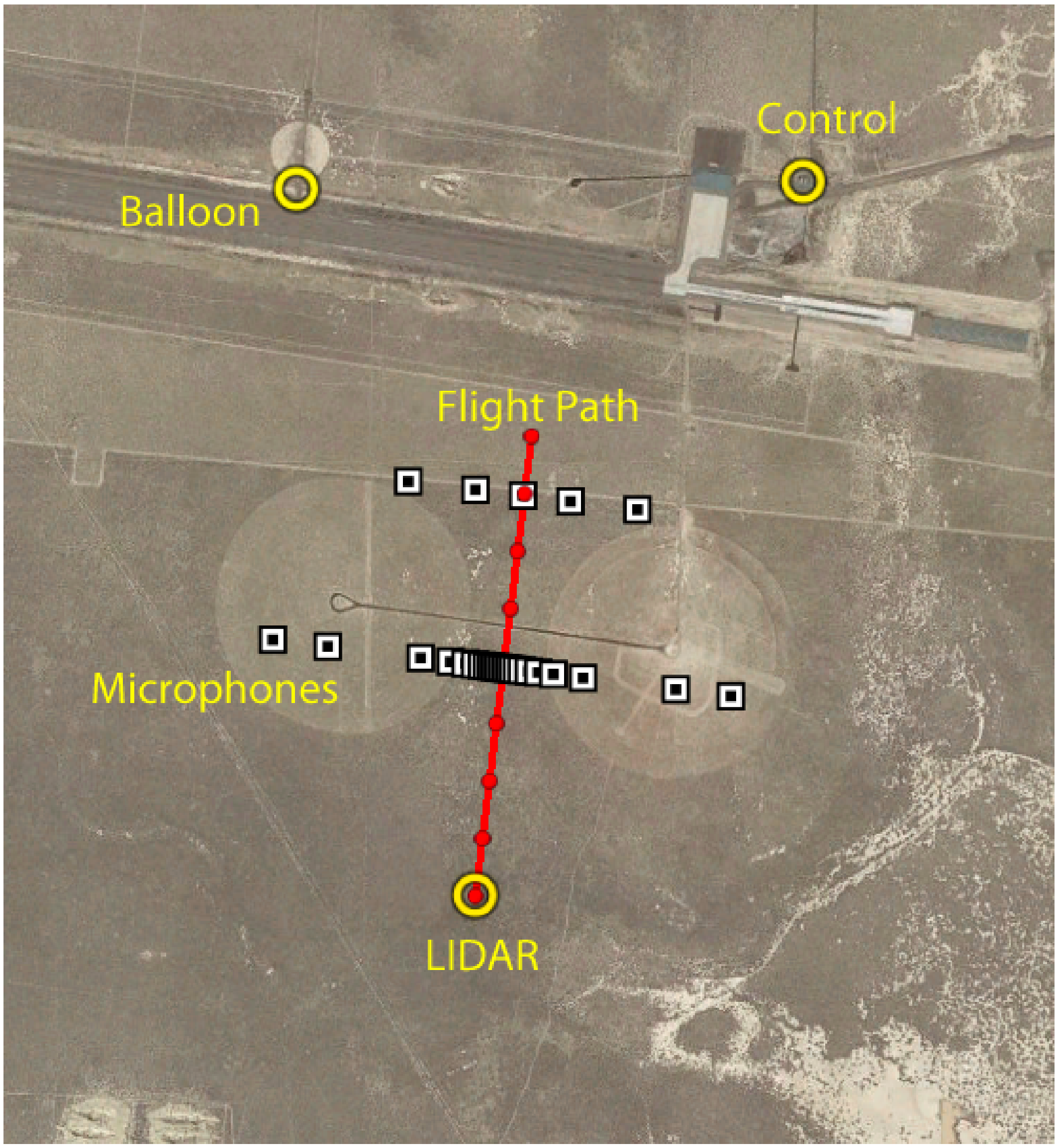


Figure 25: Amedee test site.

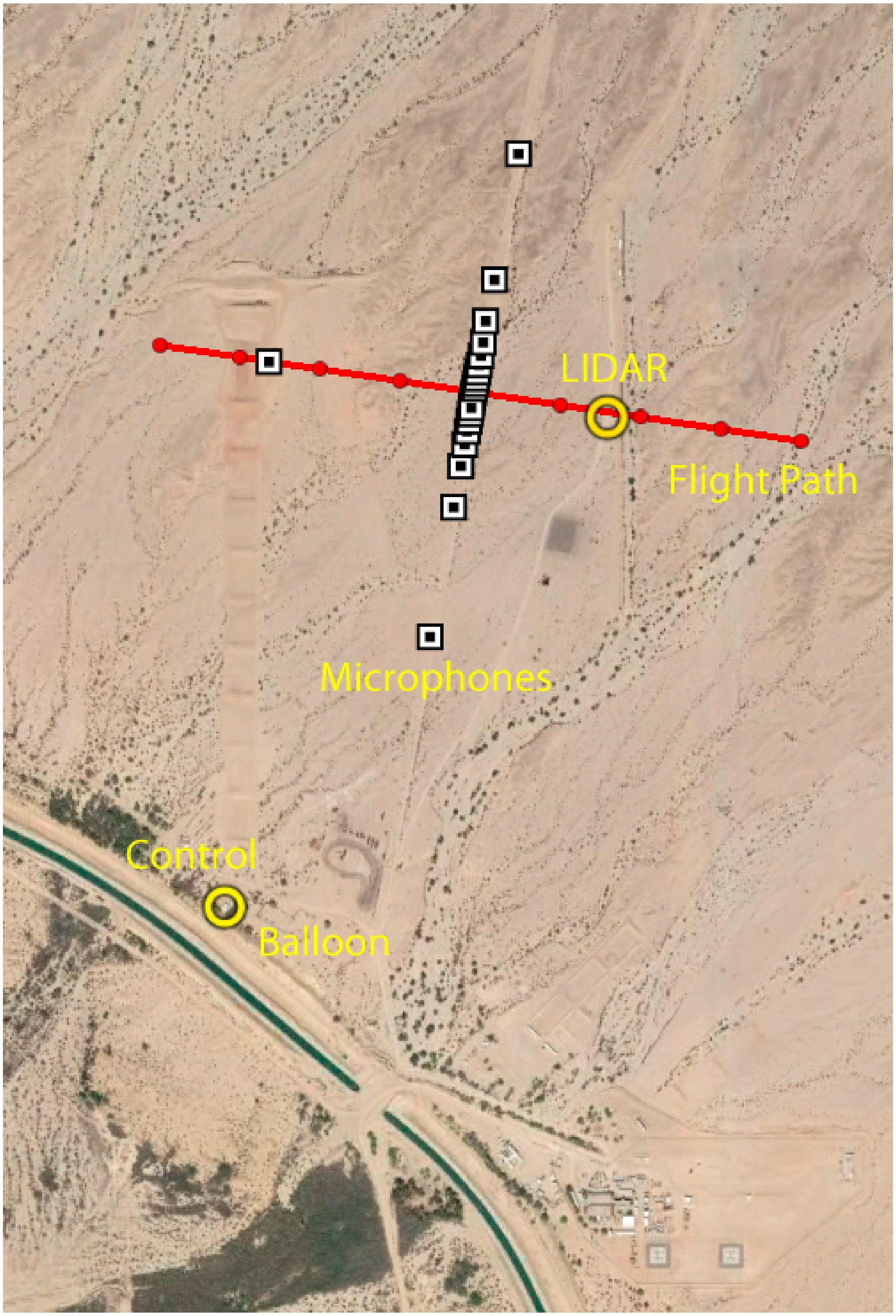
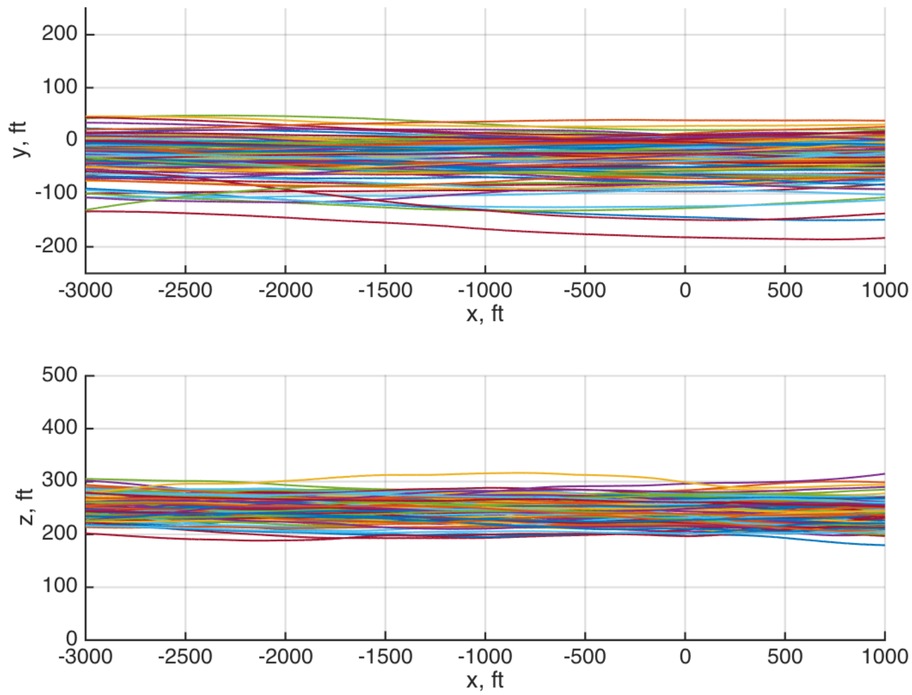
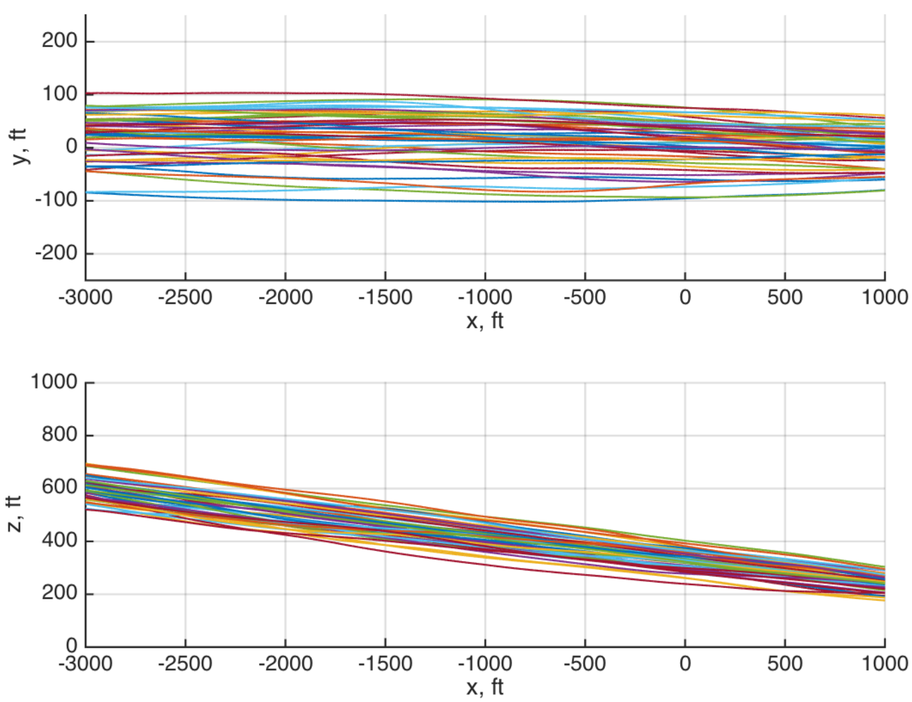


Figure 26: Salton Sea test site.

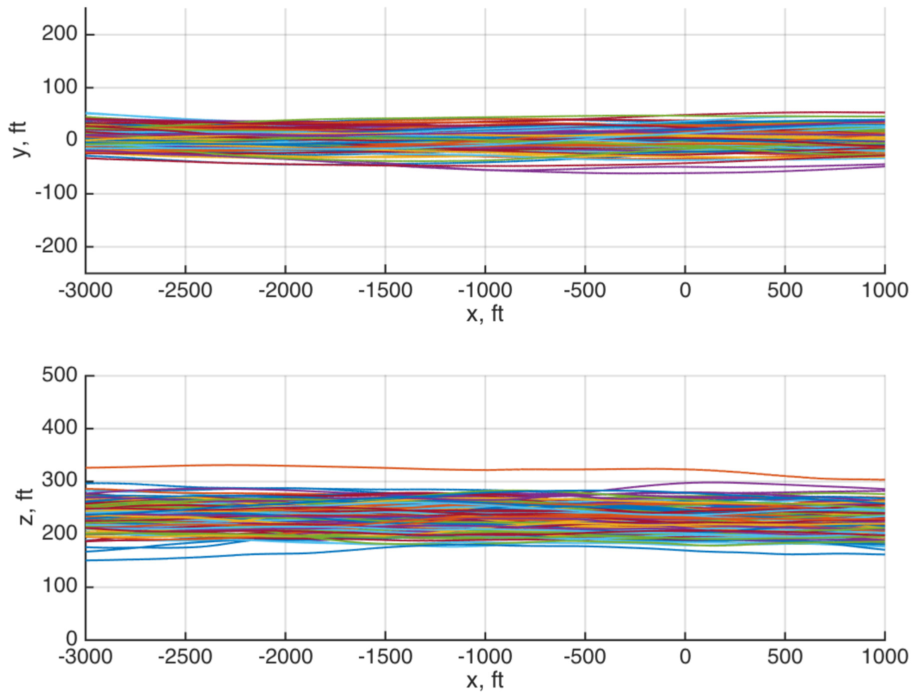


(a) Level flight conditions

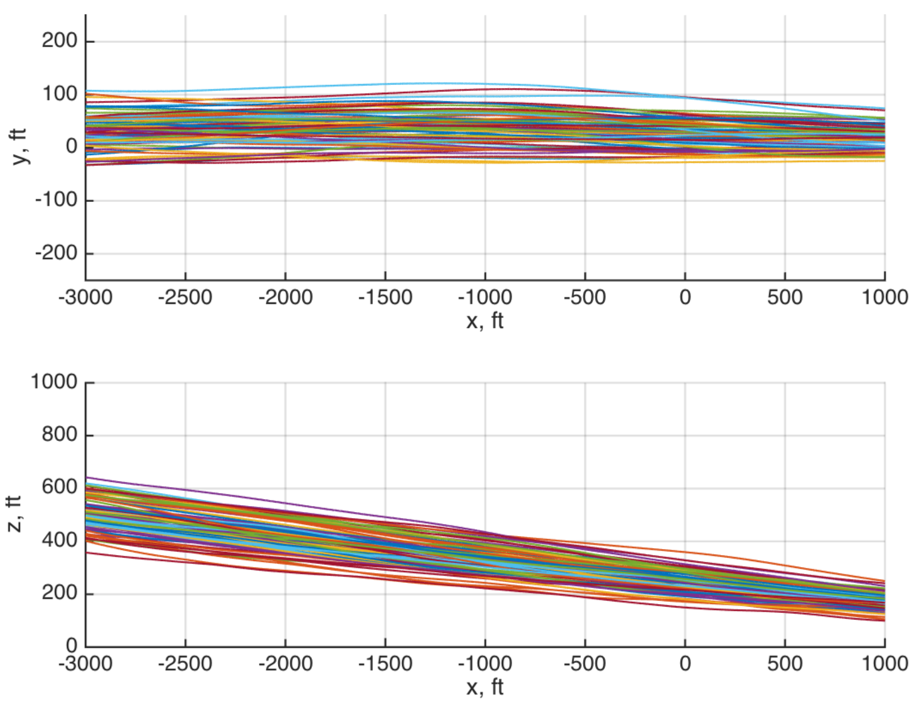


(b) Descending flight conditions

Figure 27: AS350 SD1 flight track repeatability for Sweetwater test phase.

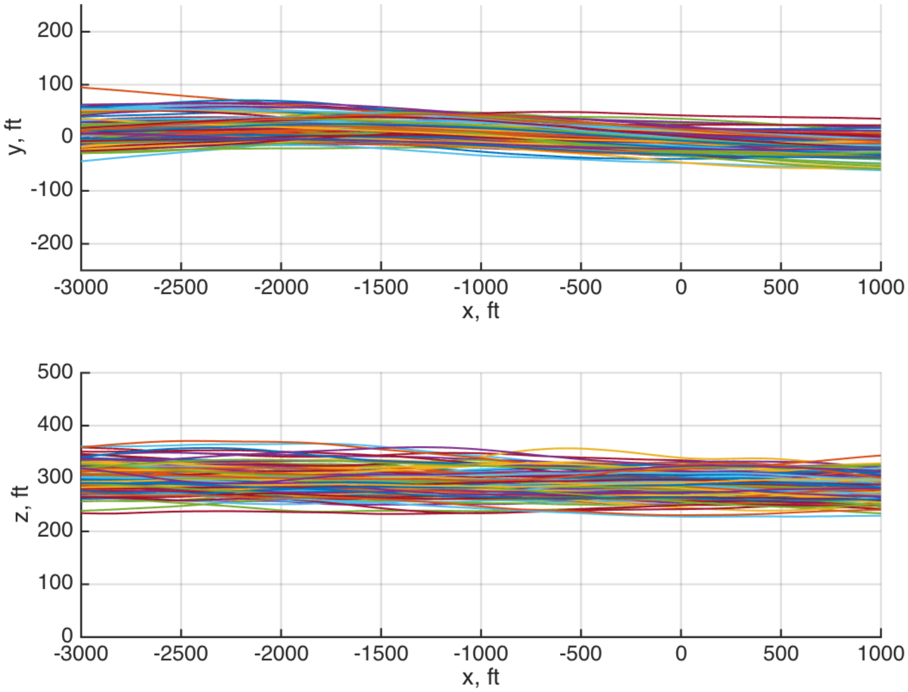


(a) Level flight conditions

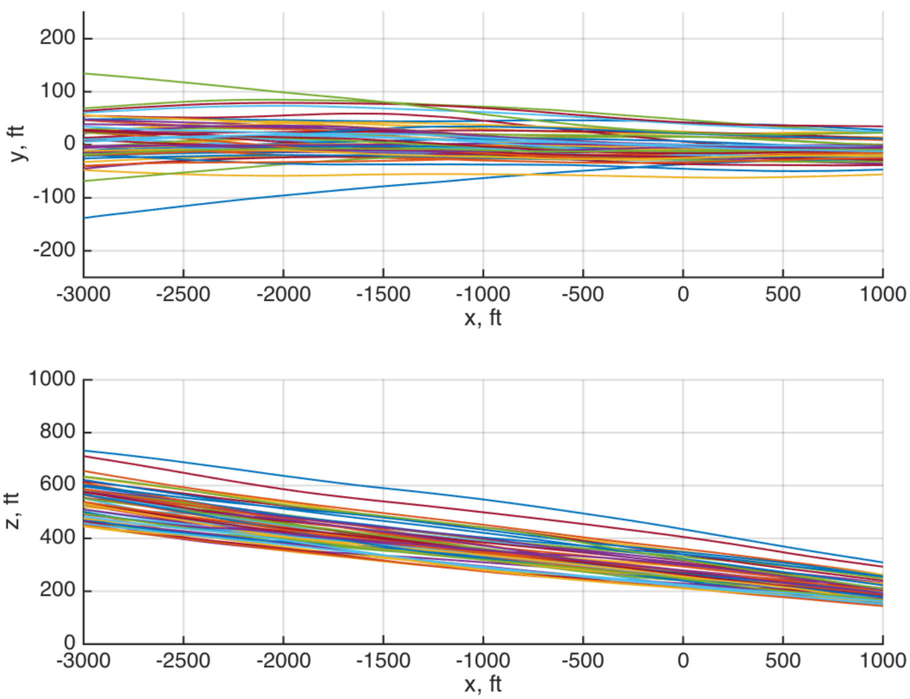


(b) Descending flight conditions

Figure 28: AS350 SD1 flight track repeatability for Amedee test phase.



(a) Level flight conditions



(b) Descending flight conditions

Figure 29: AS350 SD1 flight track repeatability for Salton Sea test phase.

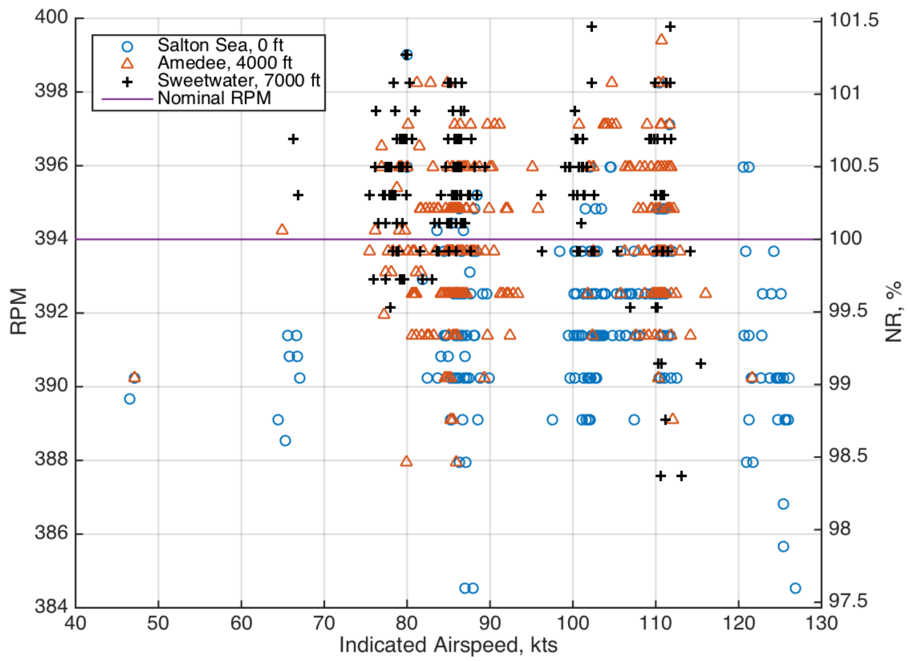


Figure 30: RPM variation for all test points for the AS350 SD1.

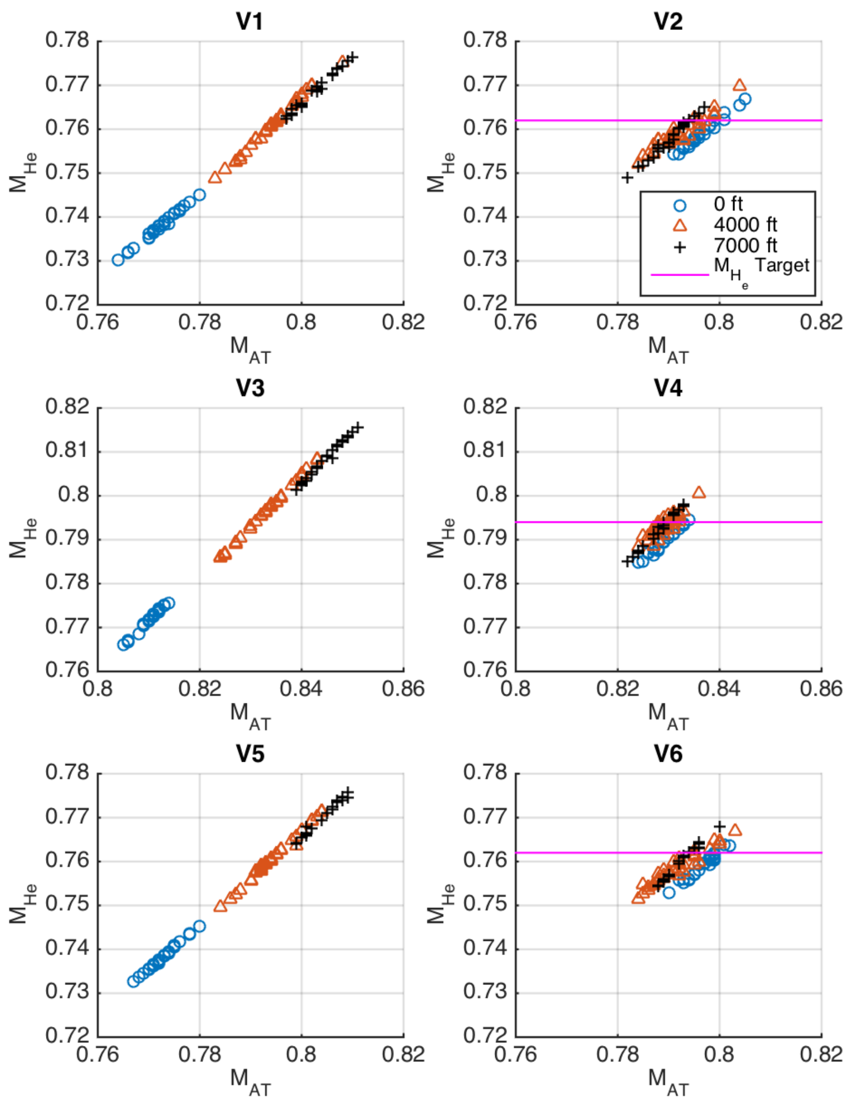


Figure 31: M_{H_e} vs M_{AT} for AS350 SD1.

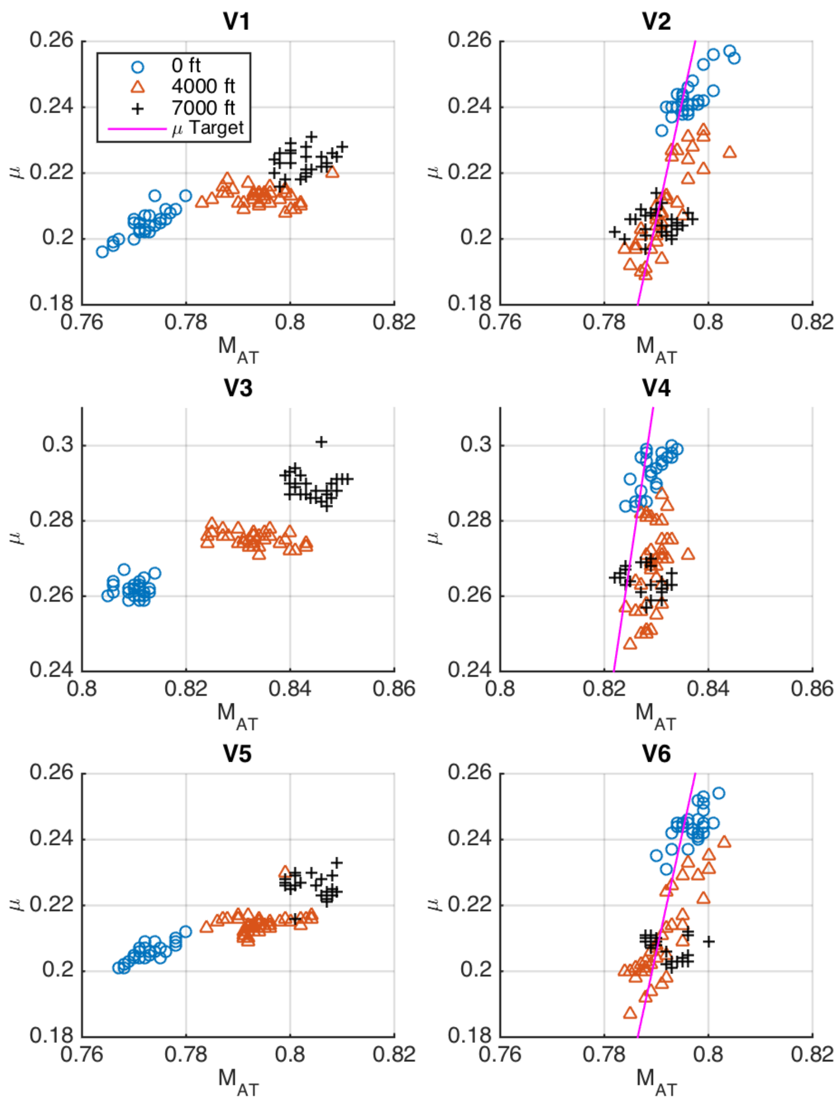


Figure 32: μ vs M_{AT} for AS350 SD1.

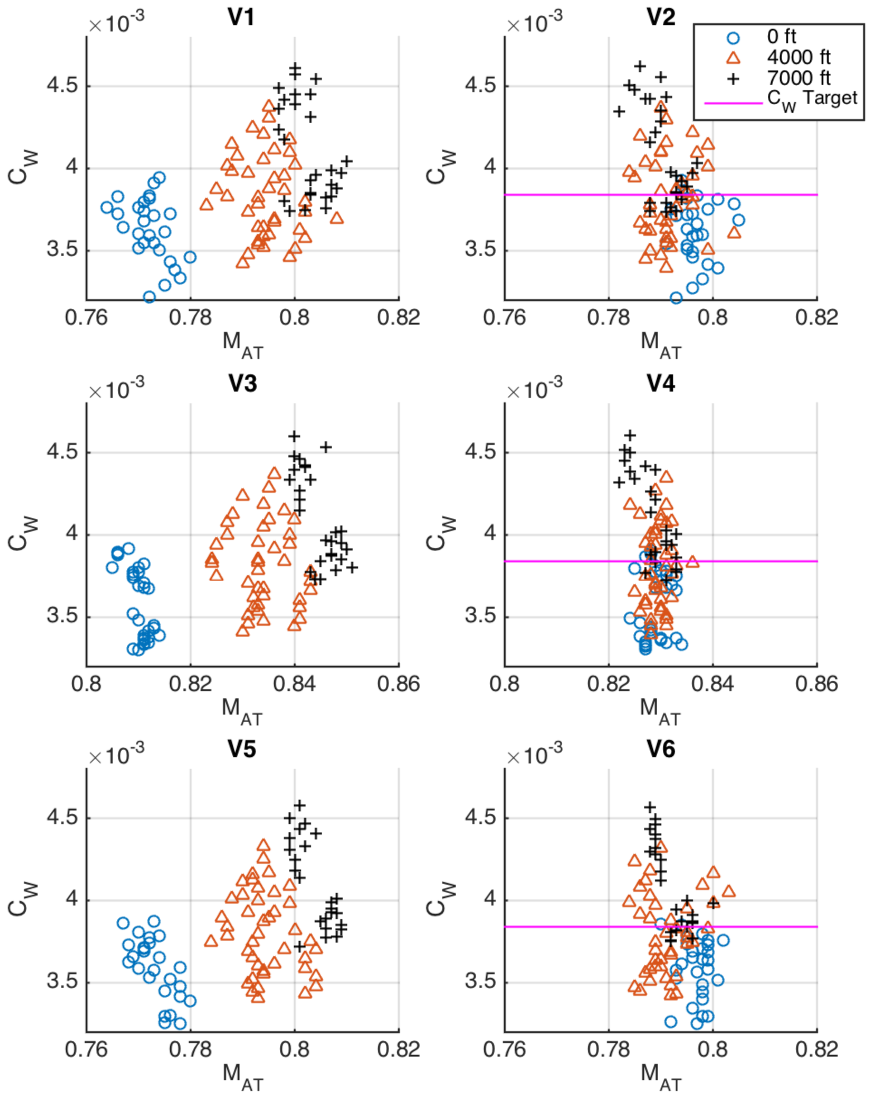


Figure 33: C_W vs M_{AT} for AS350 SD1.

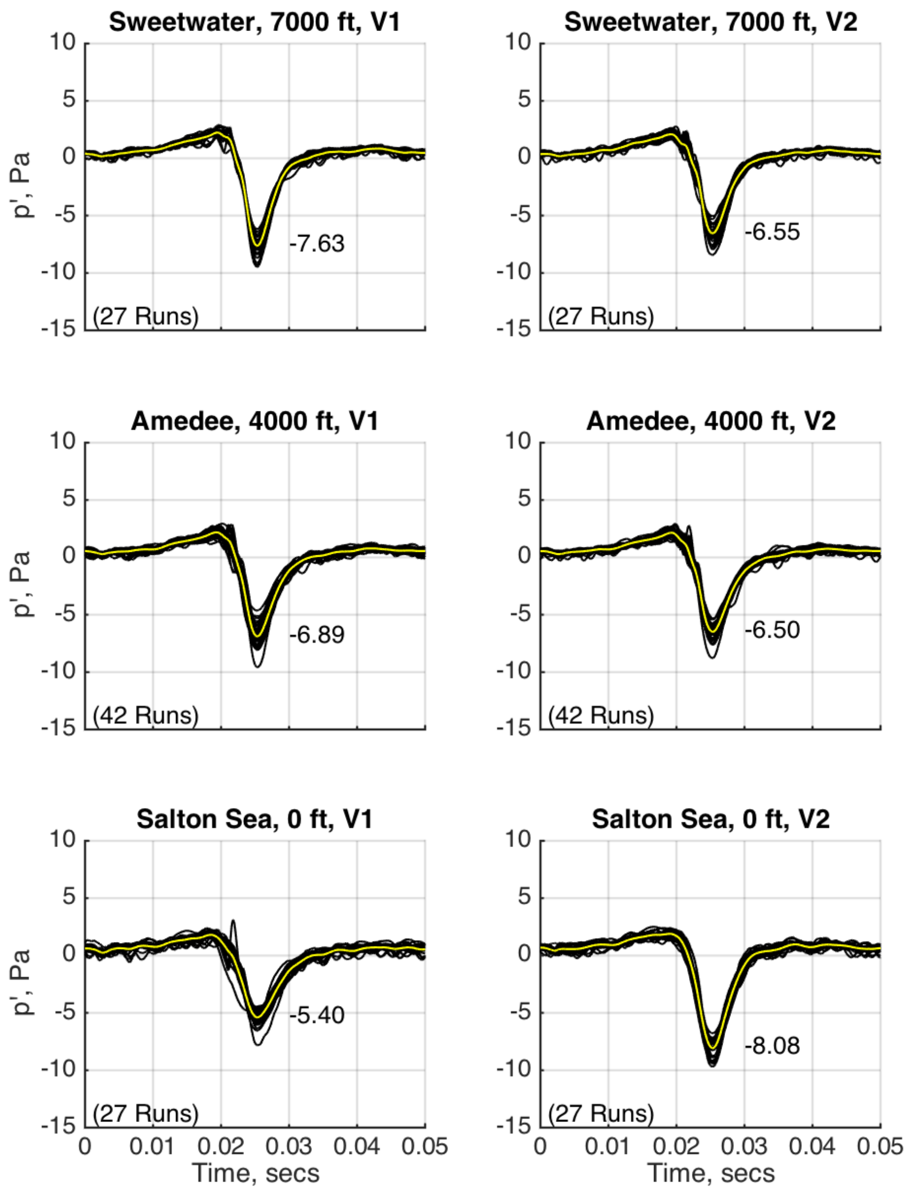


Figure 34: Averaged AS350 SD1 main rotor pulse, V1 and V2, 15° elevation angle.

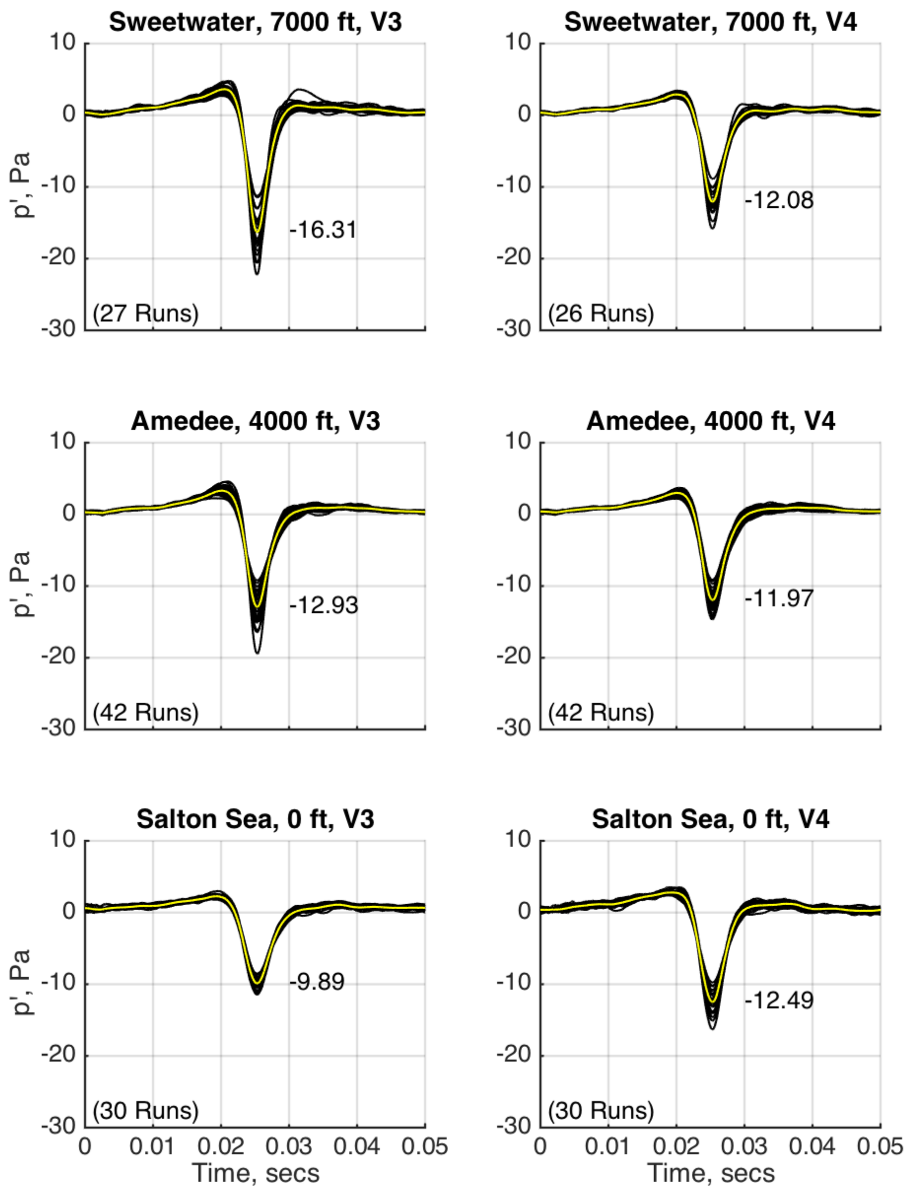


Figure 35: Averaged AS350 SD1 main rotor pulse, V3 and V4, 15° elevation angle.

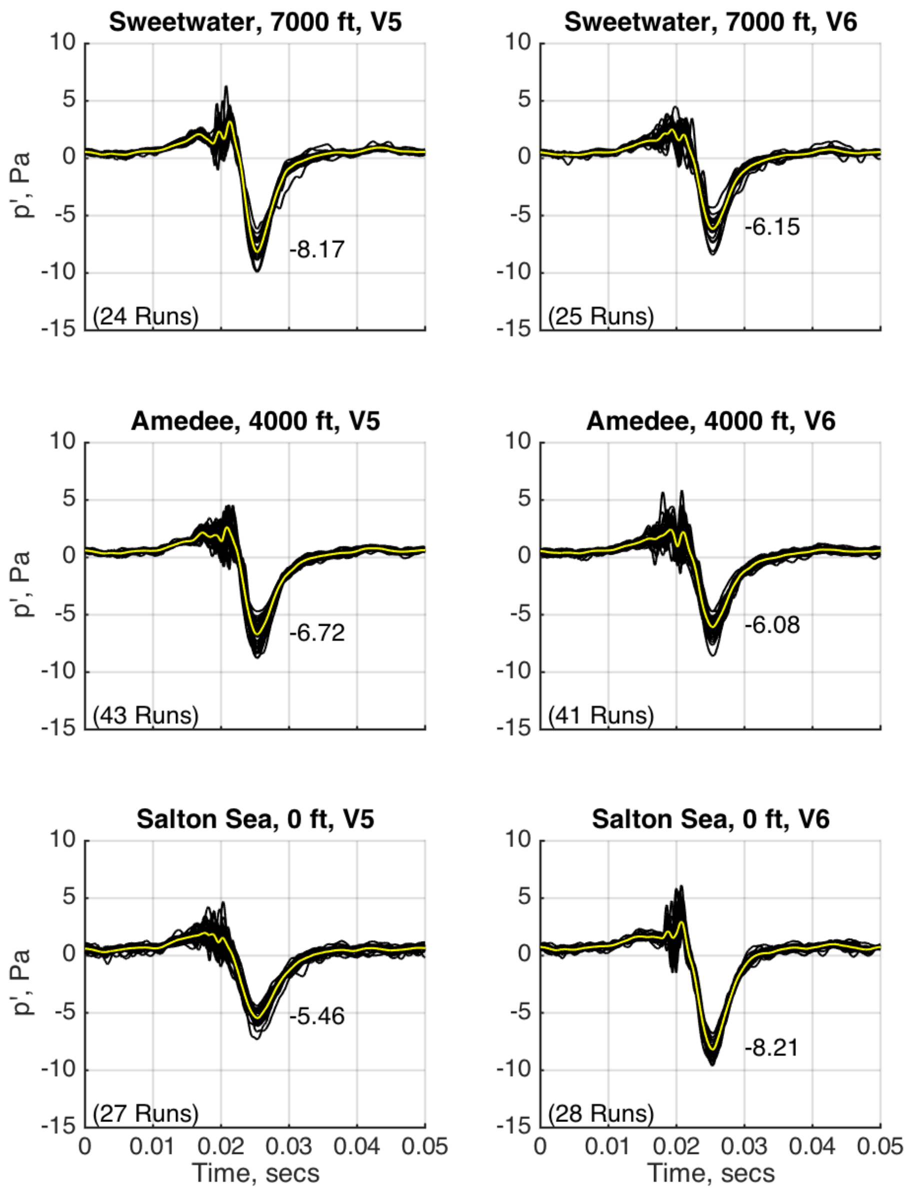


Figure 36: Averaged AS350 SD1 main rotor pulse, V5 and V6, 15° elevation angle.

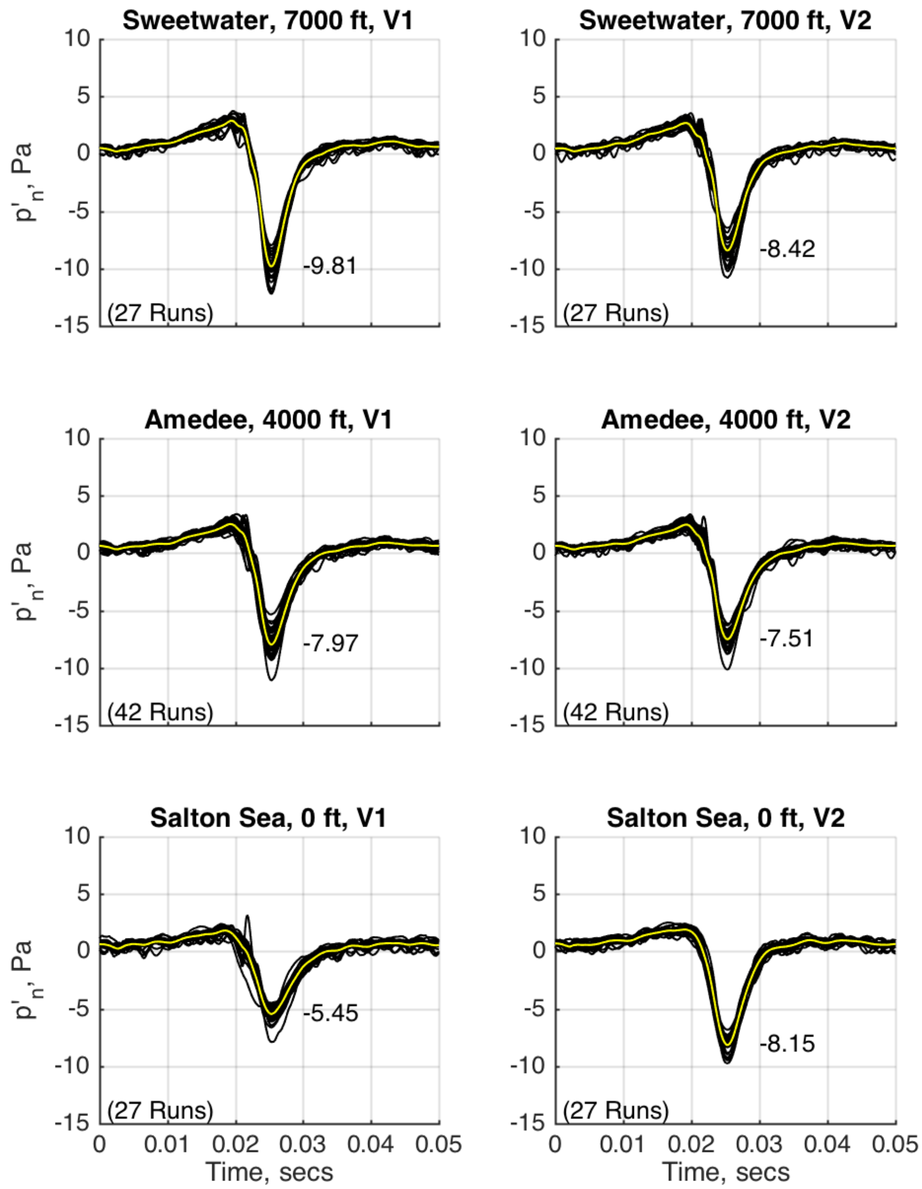


Figure 37: Normalized averaged AS350 SD1 main rotor pulse, V1 and V2, 15° elevation angle.

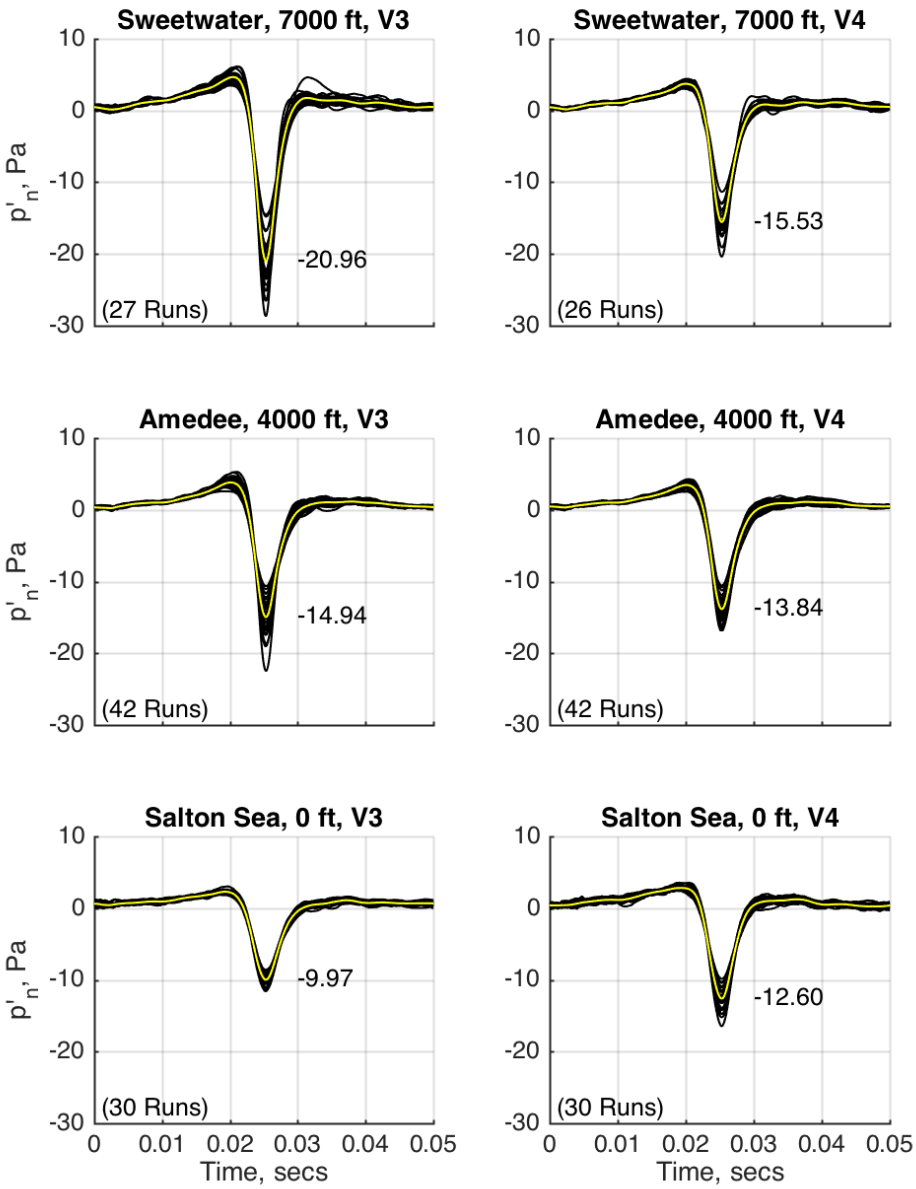


Figure 38: Normalized averaged AS350 SD1 main rotor pulse, V3 and V4, 15° elevation angle.

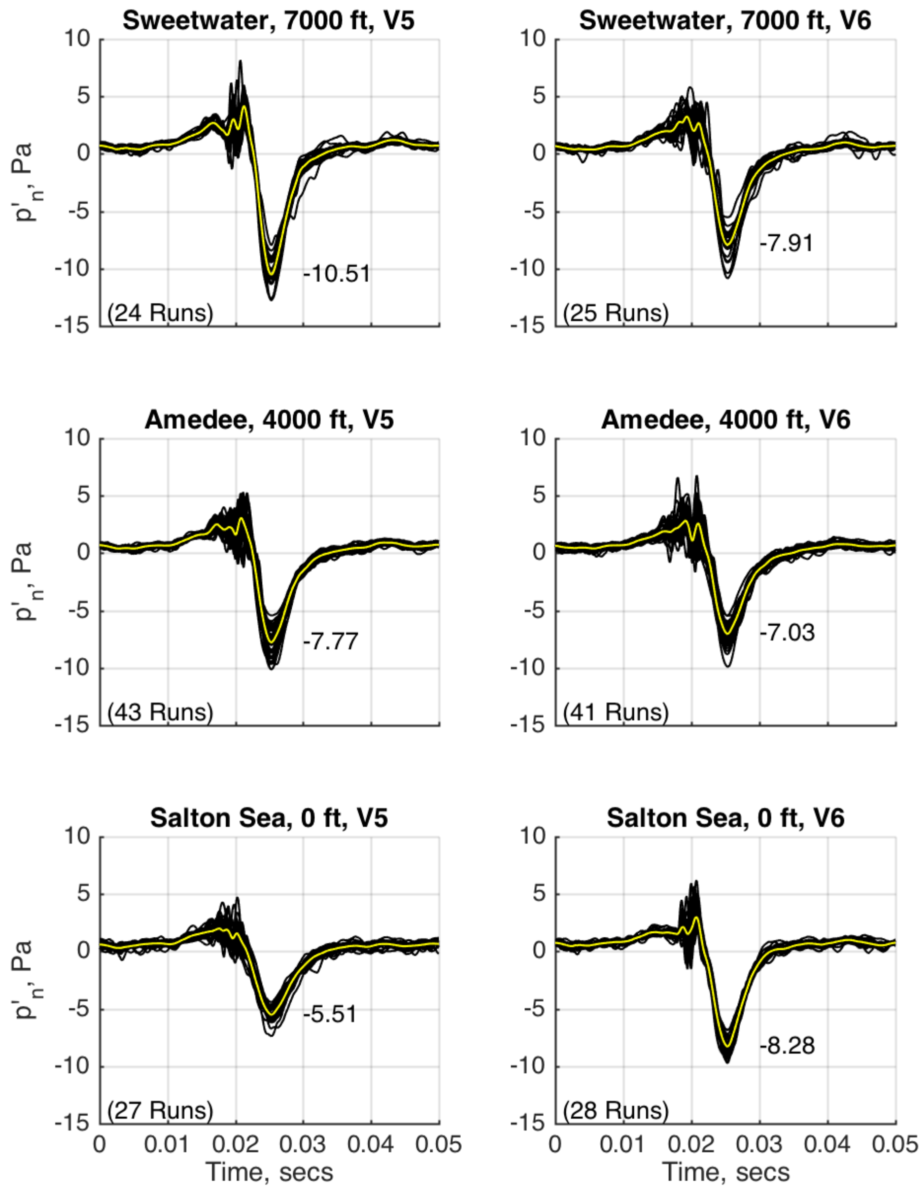


Figure 39: Normalized averaged AS350 SD1 main rotor pulse, V5 and V6, 15° elevation angle.

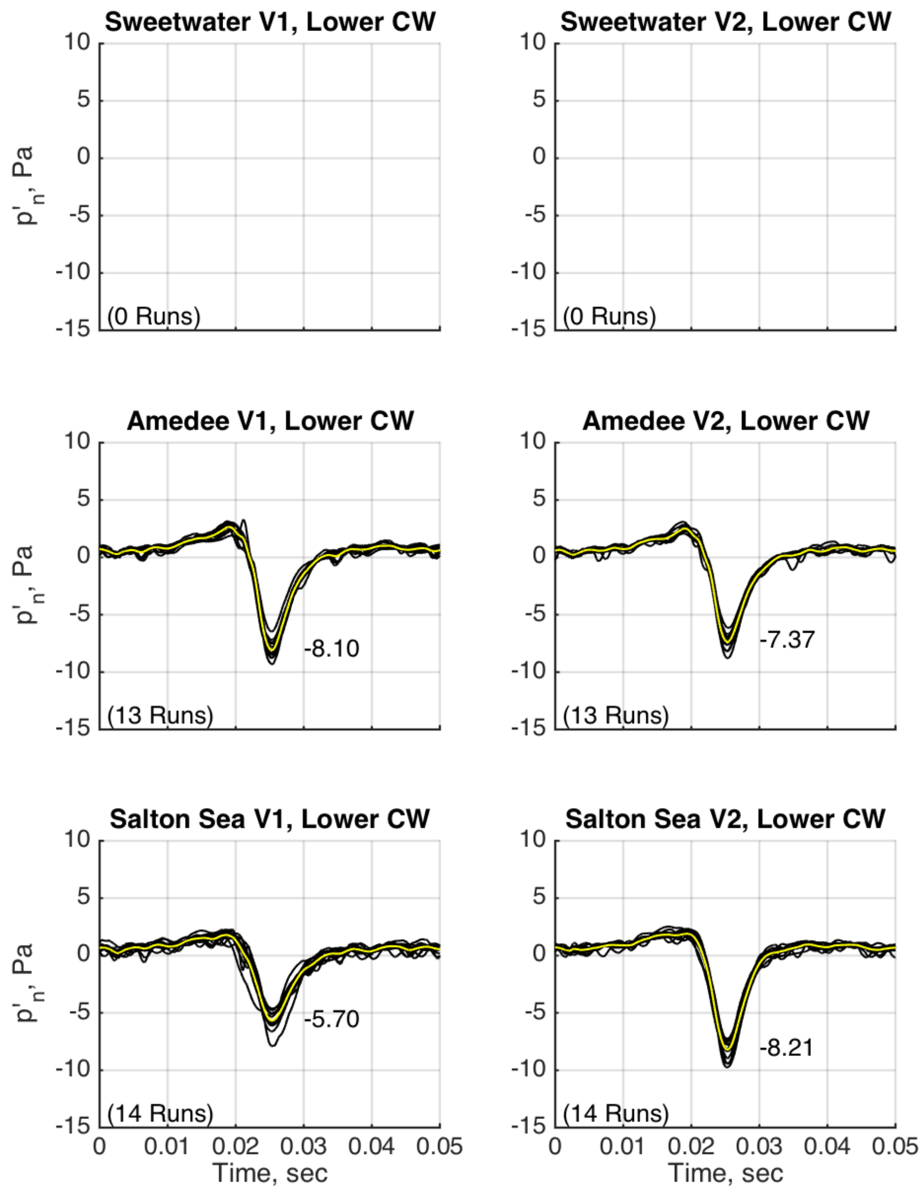


Figure 40: Averaged AS350 SD1 main rotor pulse, lower C_W range, V1 and V2, 15° elevation angle.

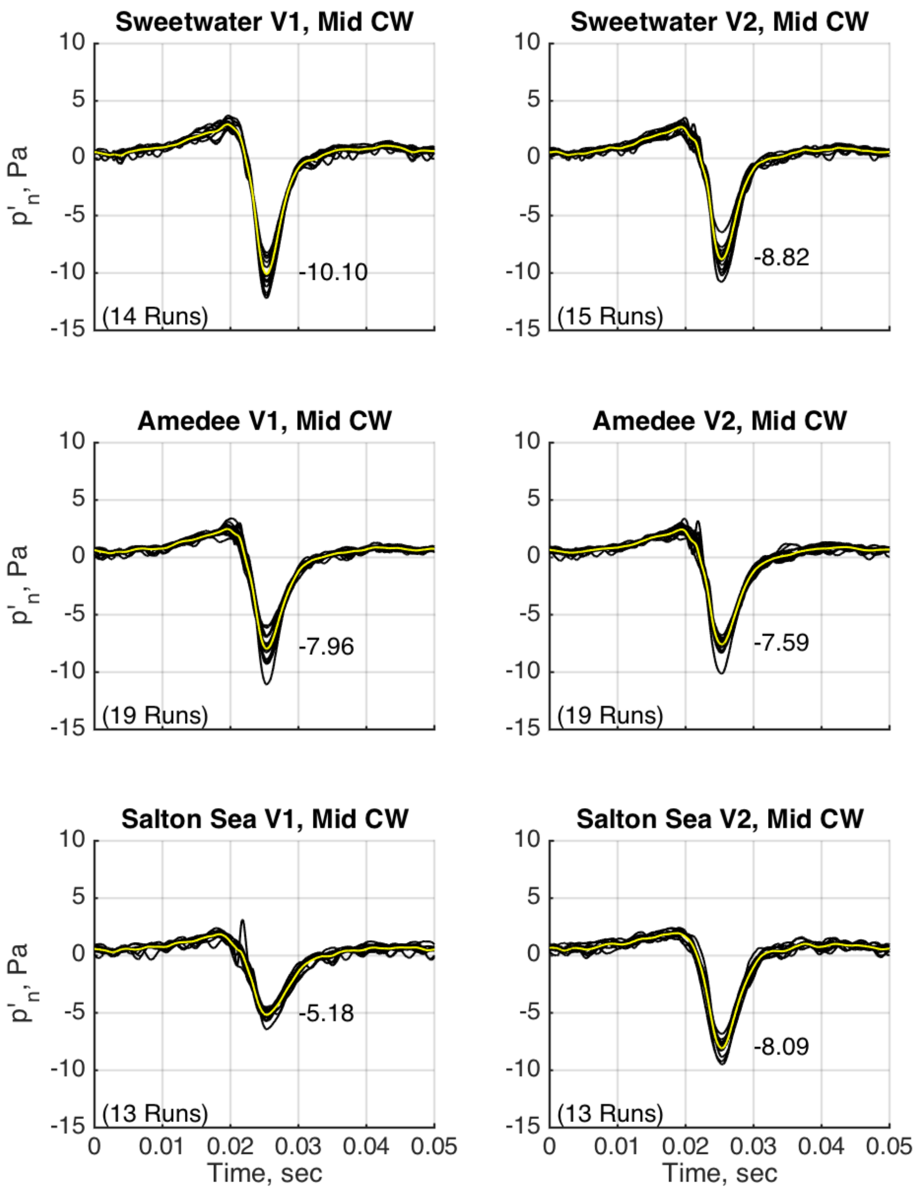


Figure 41: Averaged AS350 SD1 main rotor pulse, mid C_W range, V1 and V2, 15° elevation angle.

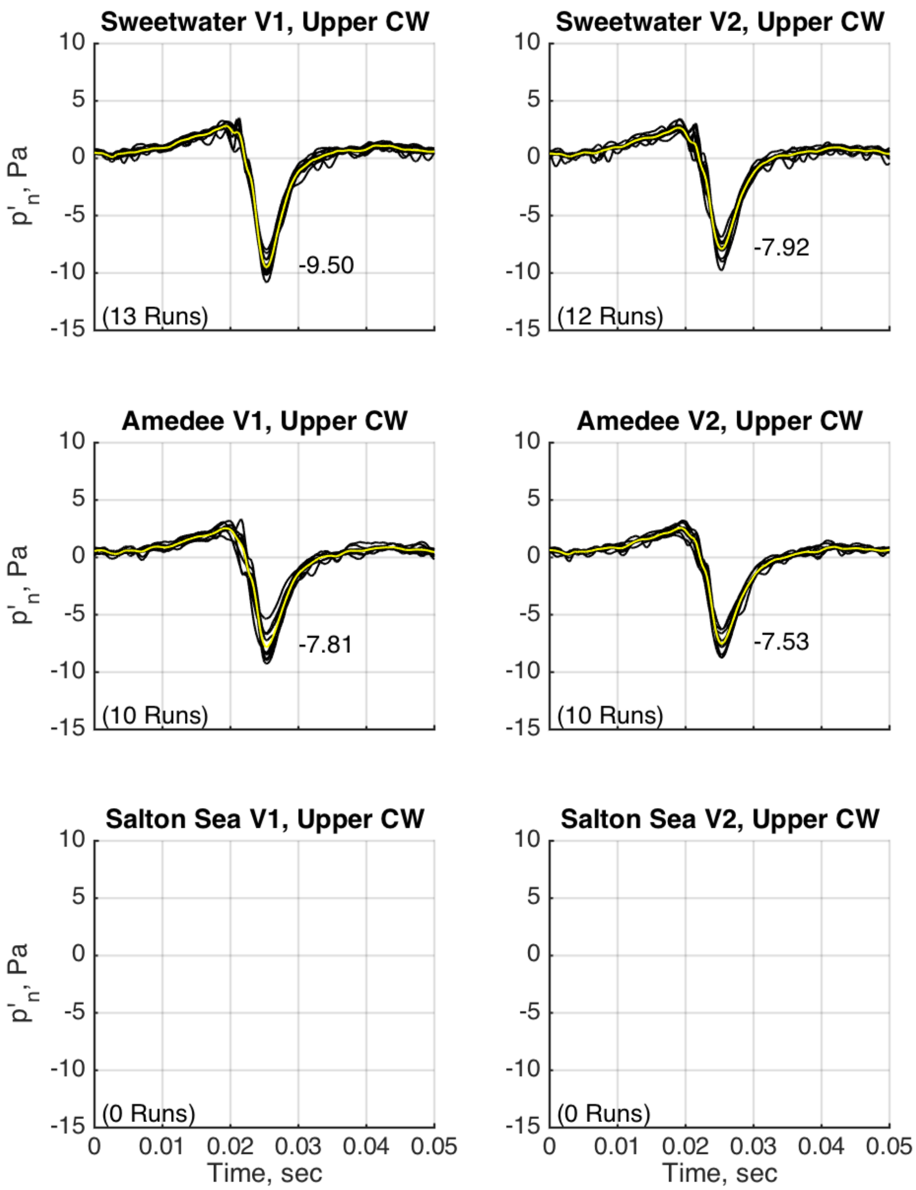


Figure 42: Averaged AS350 SD1 main rotor pulse, upper C_W range, V1 and V2, 15° elevation angle.

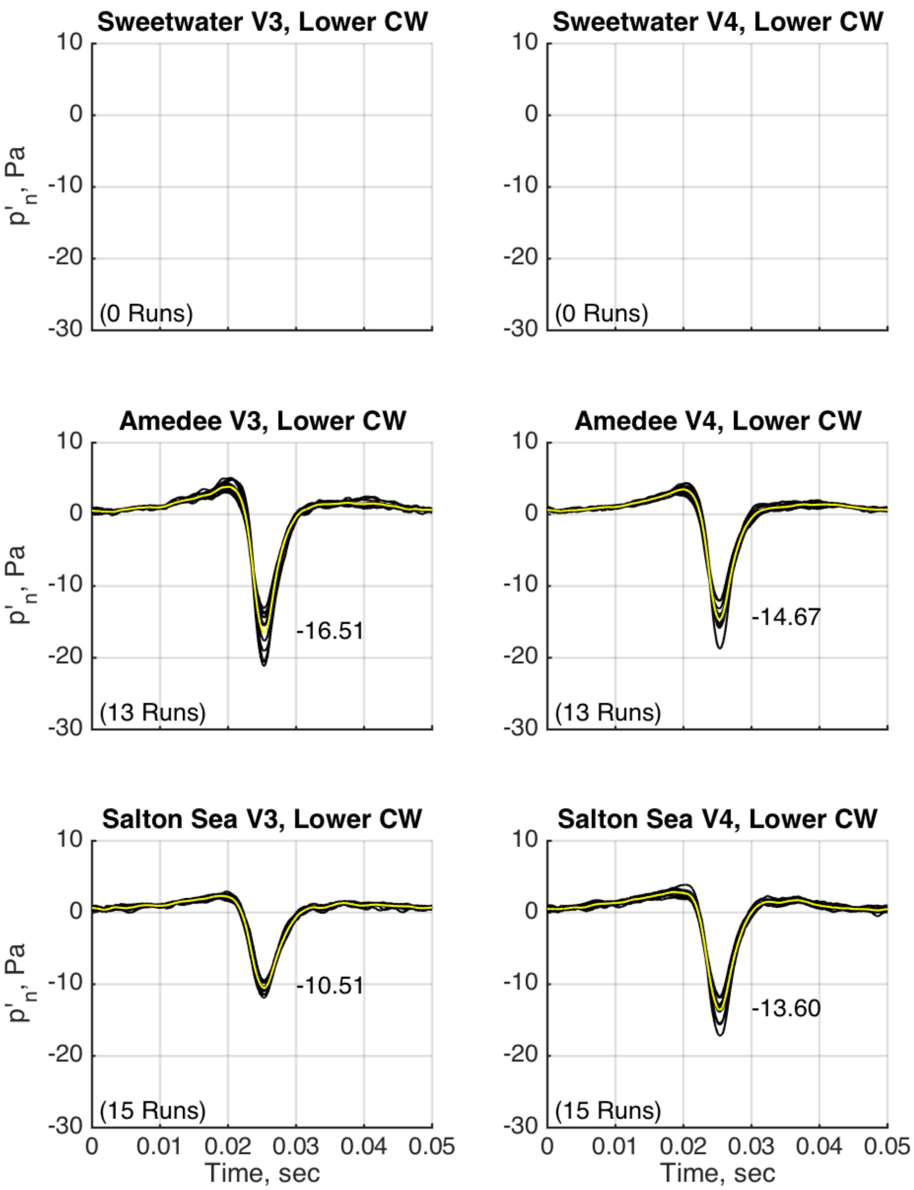


Figure 43: Averaged AS350 SD1 main rotor pulse, lower C_W range, V3 and V4, 15° elevation angle.

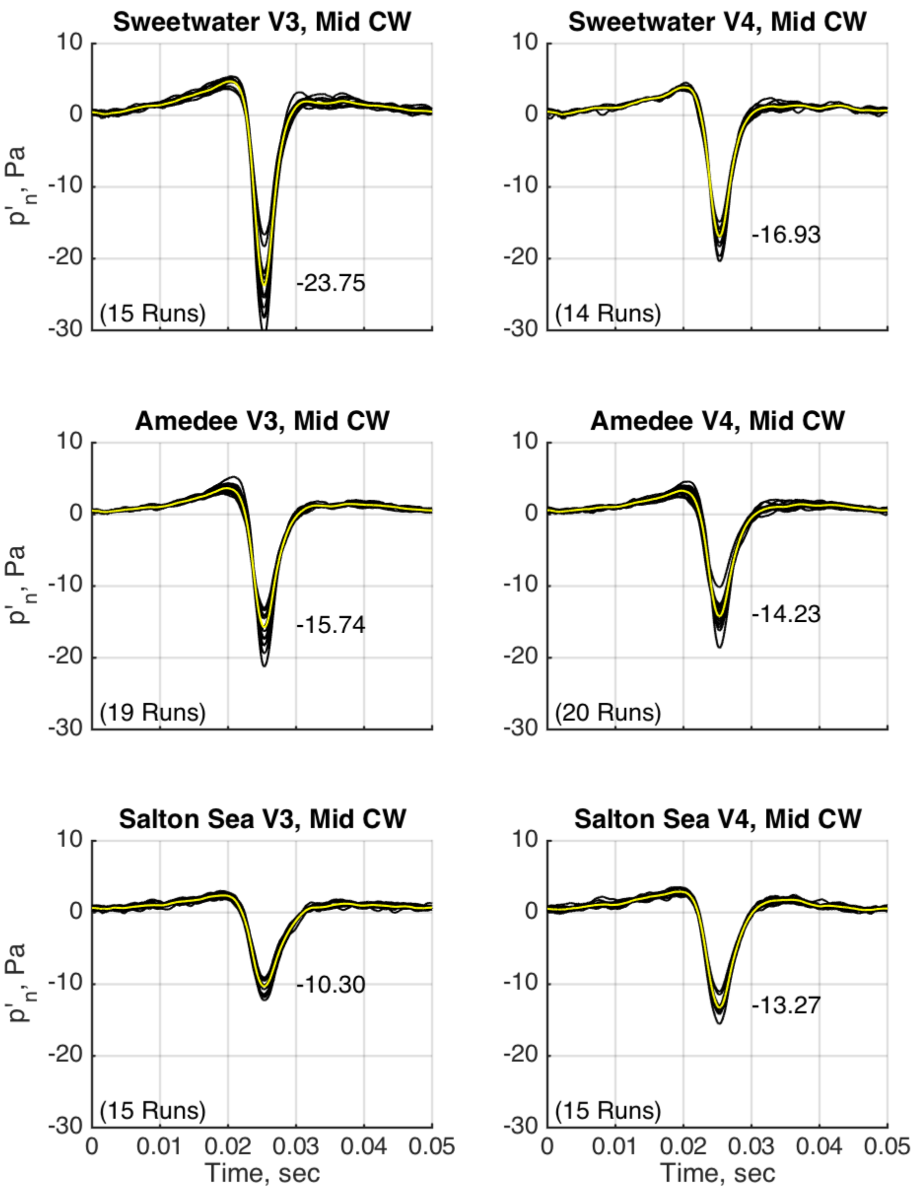


Figure 44: Averaged AS350 SD1 main rotor pulse, mid C_W range, V3 and V4, 15° elevation angle.

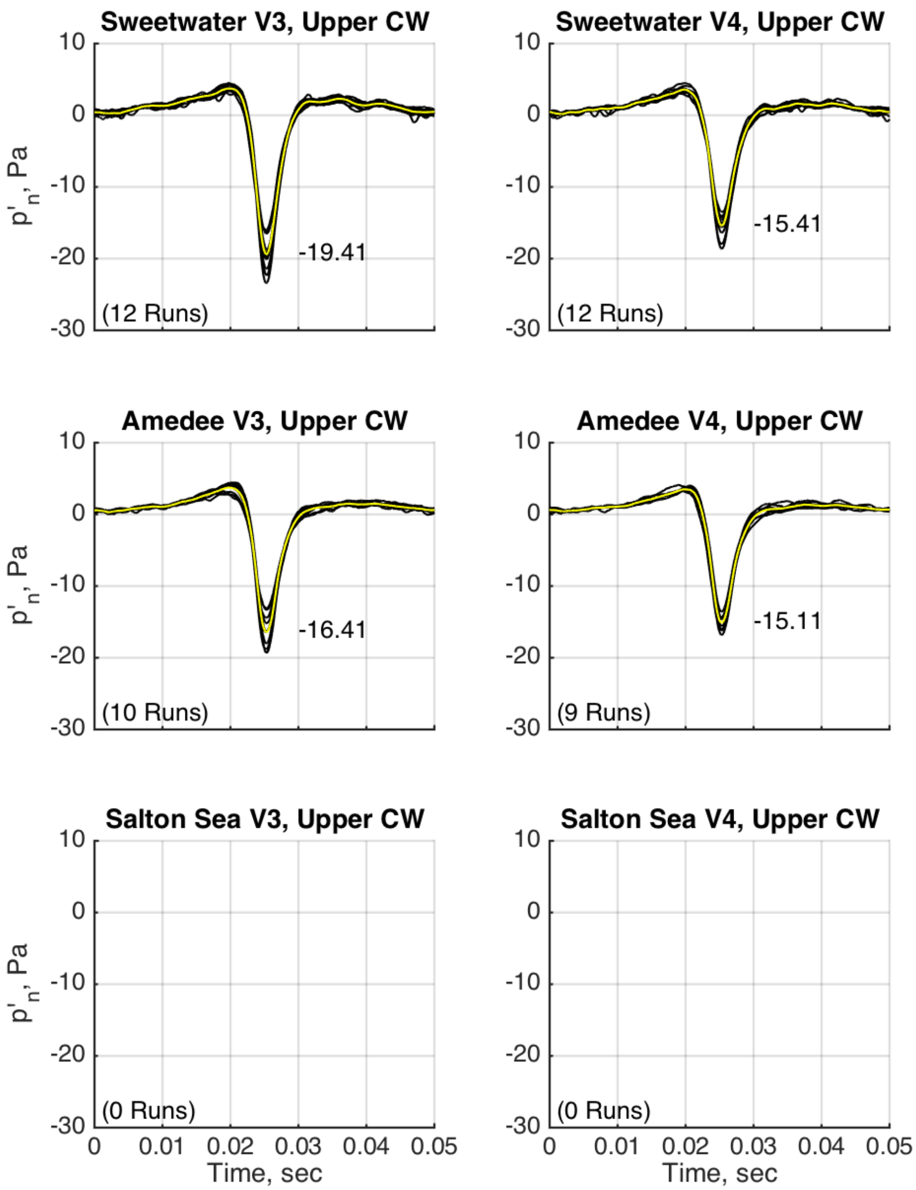


Figure 45: Averaged AS350 SD1 main rotor pulse, upper C_W range, V3 and V4, 15° elevation angle.

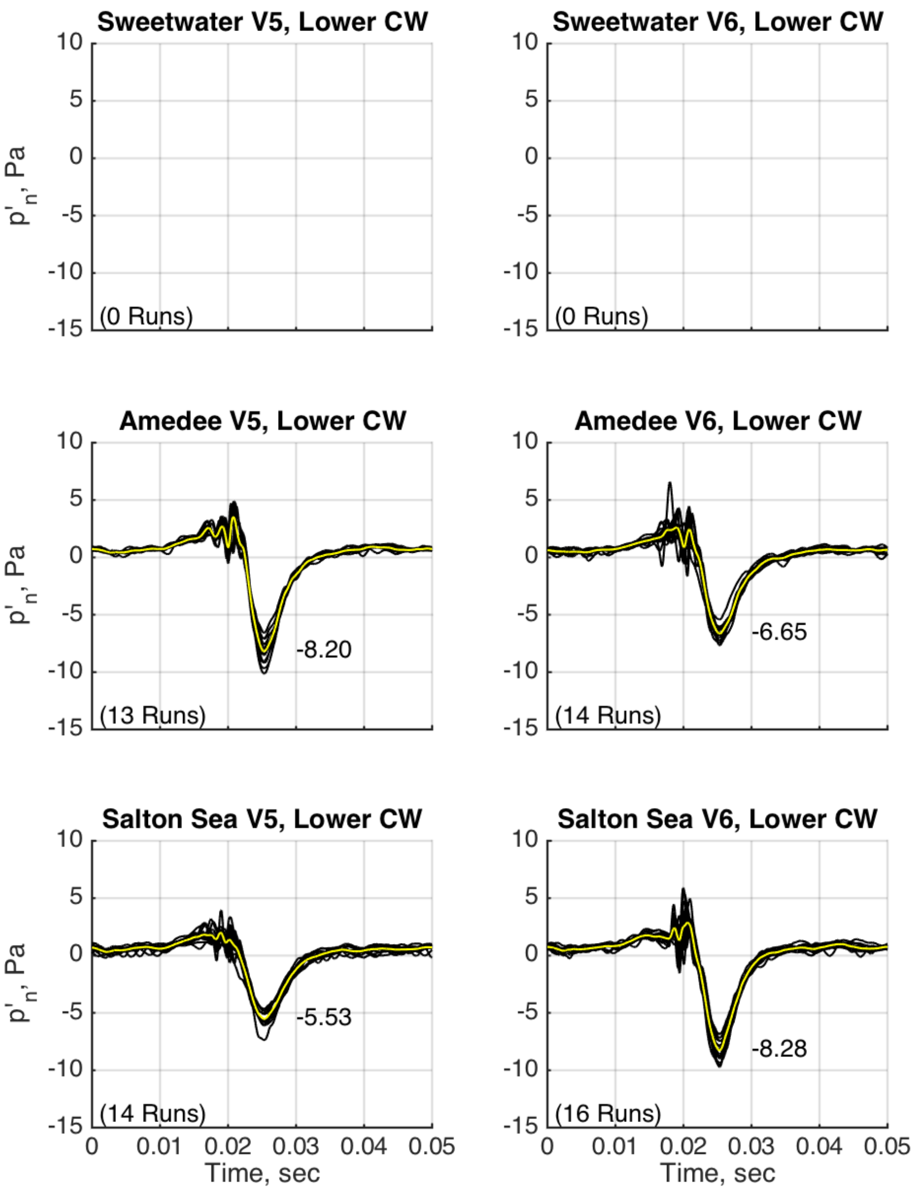


Figure 46: Averaged AS350 SD1 main rotor pulse, lower C_W range, V5 and V6, 15° elevation angle.

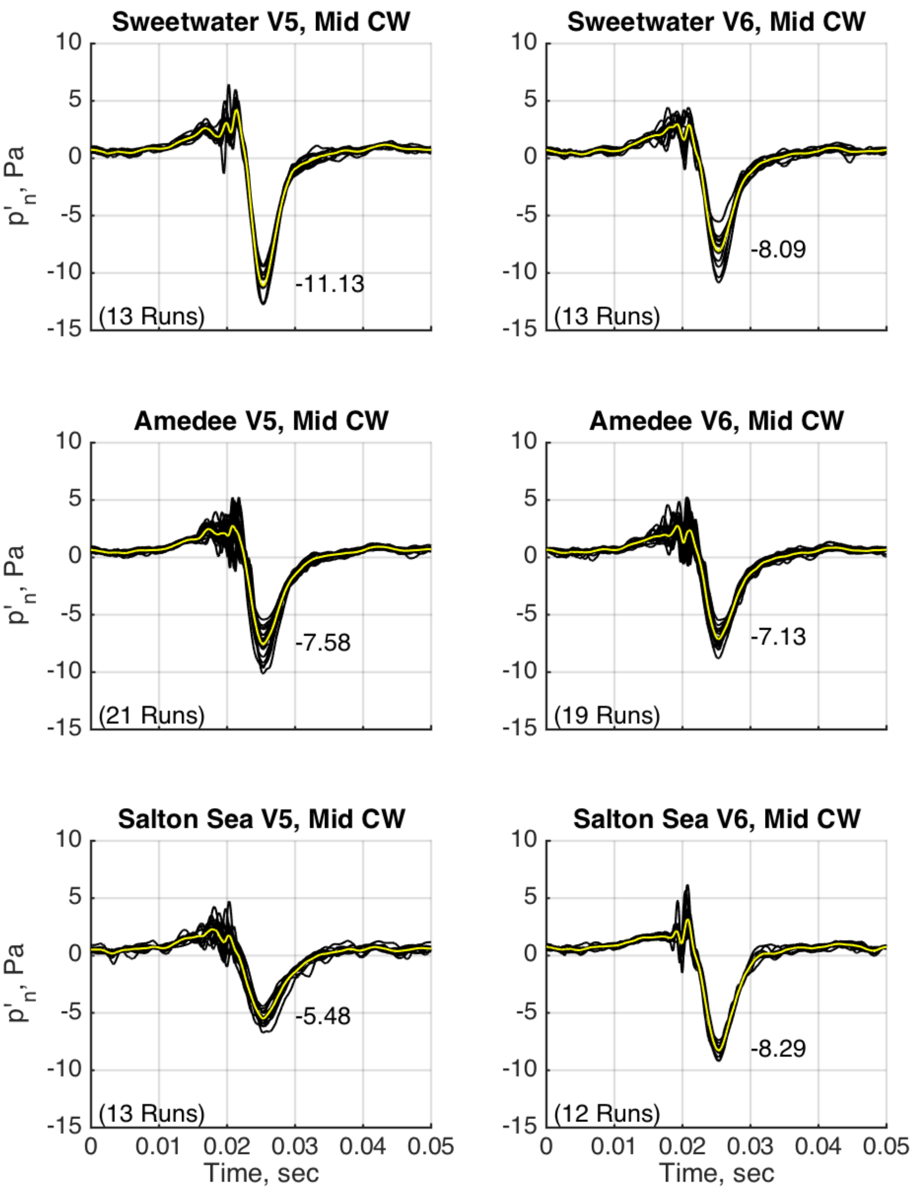


Figure 47: Averaged AS350 SD1 main rotor pulse, mid C_W range, V5 and V6, 15° elevation angle.

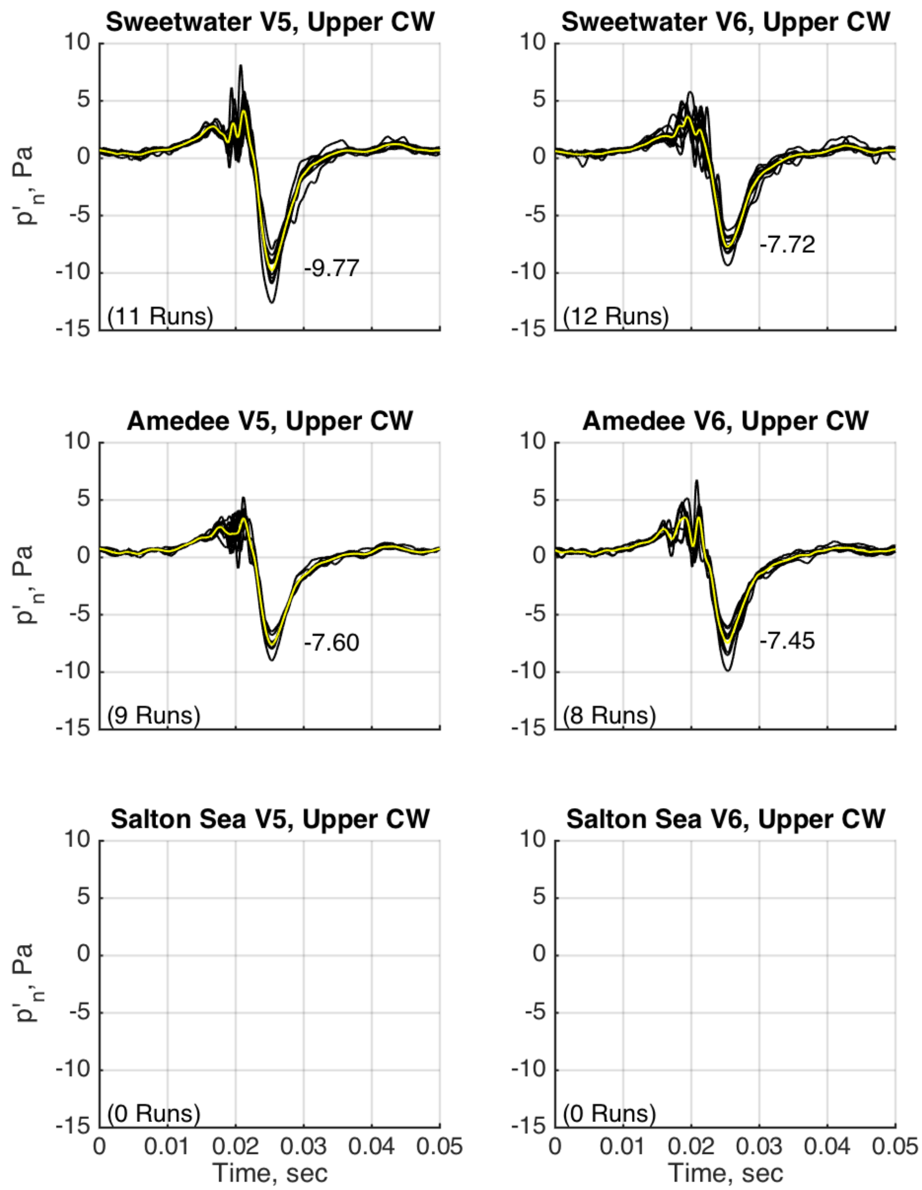


Figure 48: Averaged AS350 SD1 main rotor pulse, upper C_W range, V5 and V6, 15° elevation angle.

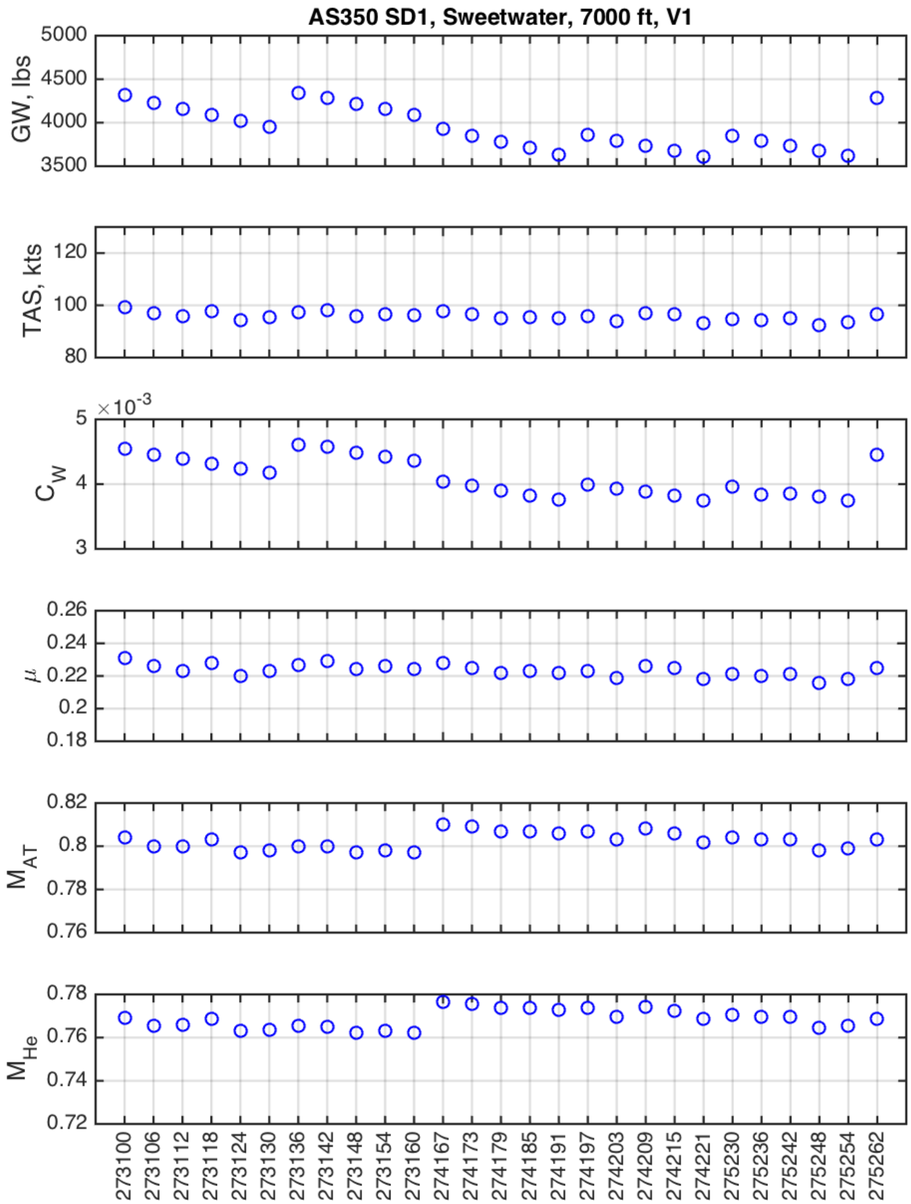


Figure 49: AS350 SD1 aircraft parameters for Sweetwater, 7000 ft, V1 test condition.

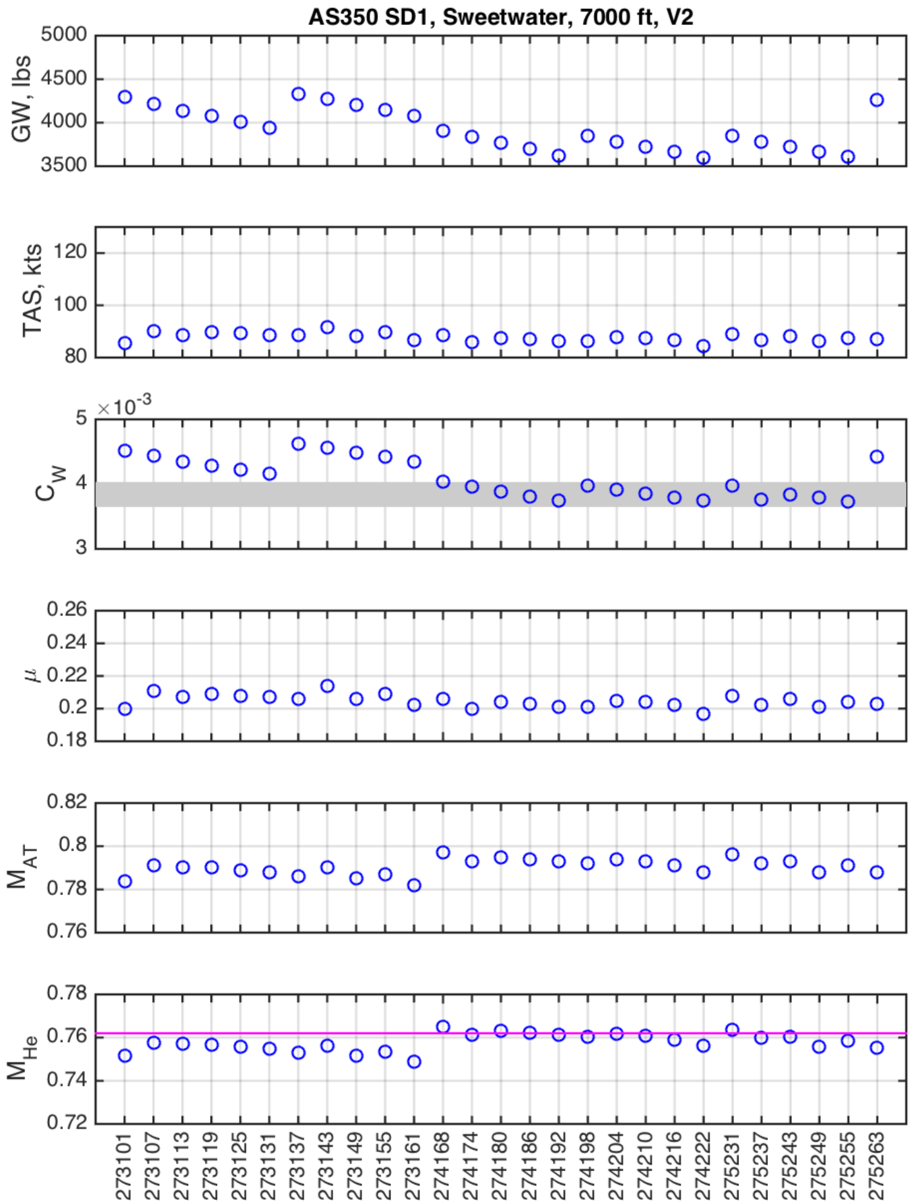


Figure 50: AS350 SD1 aircraft parameters for Sweetwater, 7000 ft, V2 test condition. Gray box is target C_W range. Magenta line is target M_{H_e}.

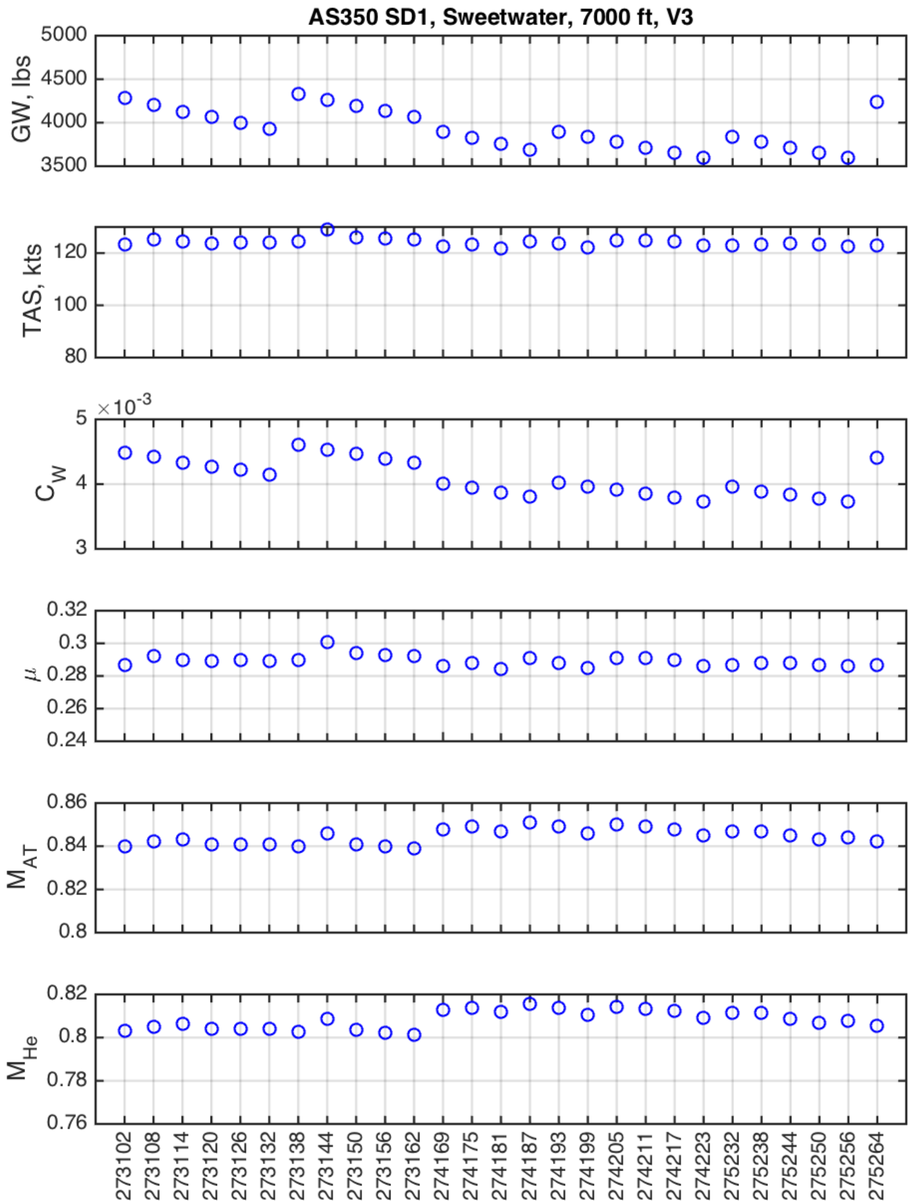


Figure 51: AS350 SD1 aircraft parameters for Sweetwater, 7000 ft, V3 test condition.

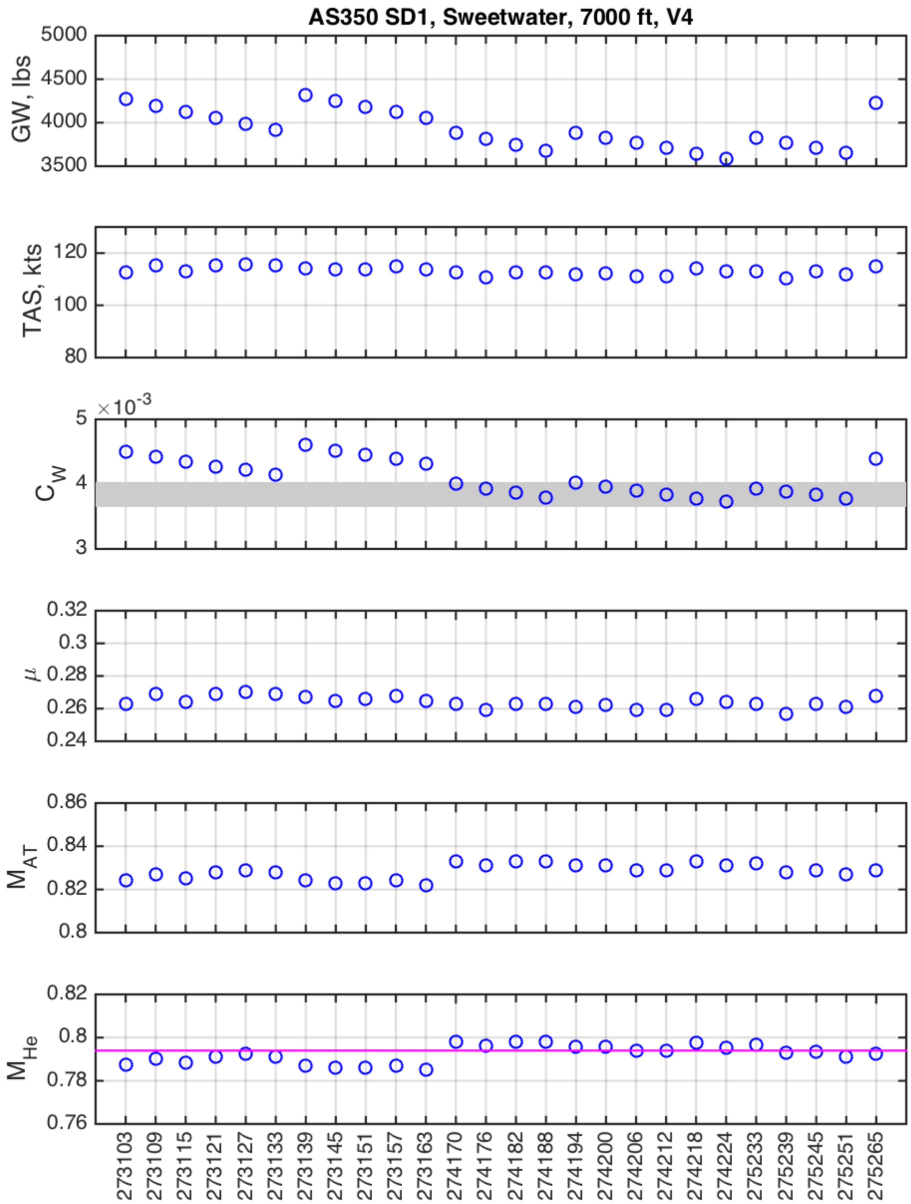


Figure 52: AS350 SD1 aircraft parameters for Sweetwater, 7000 ft, V4 test condition. Gray box is target C_W range. Magenta line is target M_{H_e}.

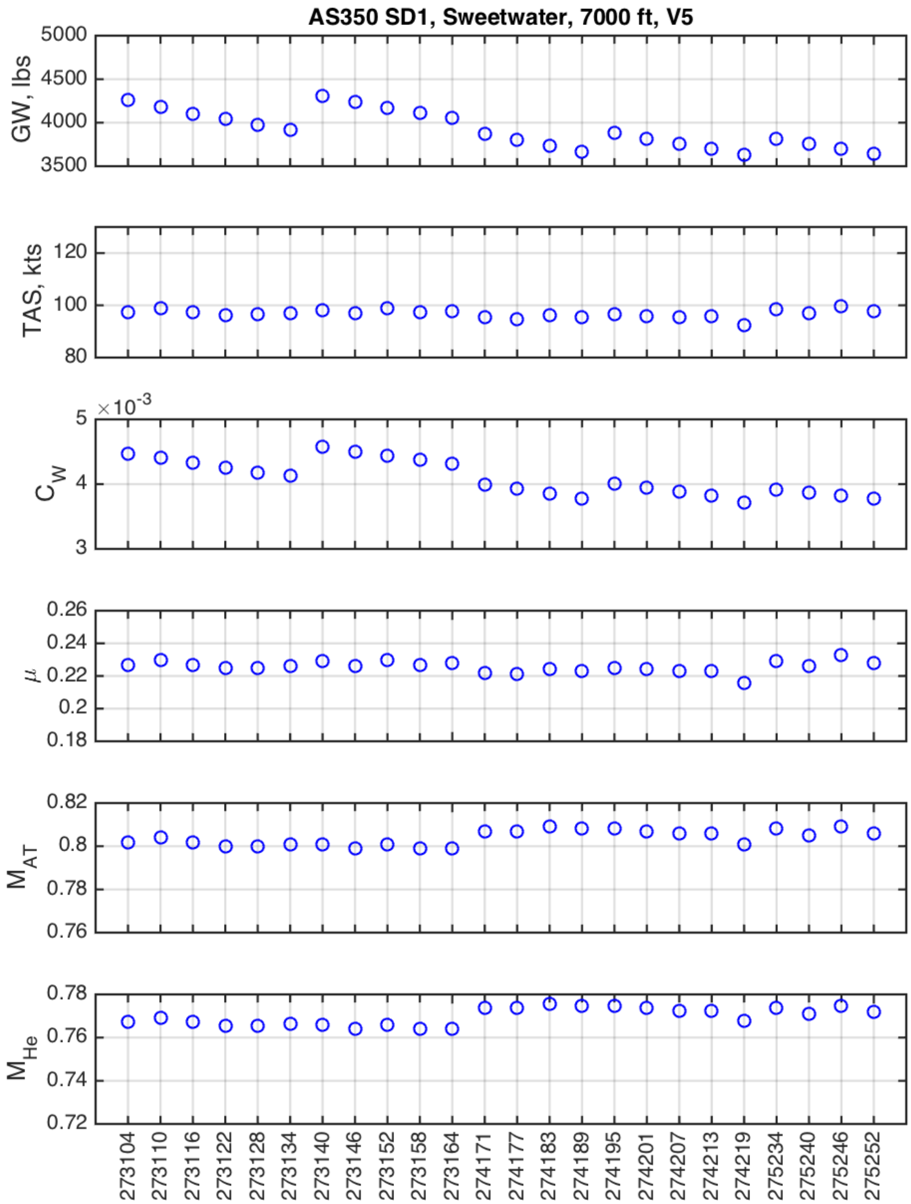


Figure 53: AS350 SD1 aircraft parameters for Sweetwater, 7000 ft, V5 test condition.

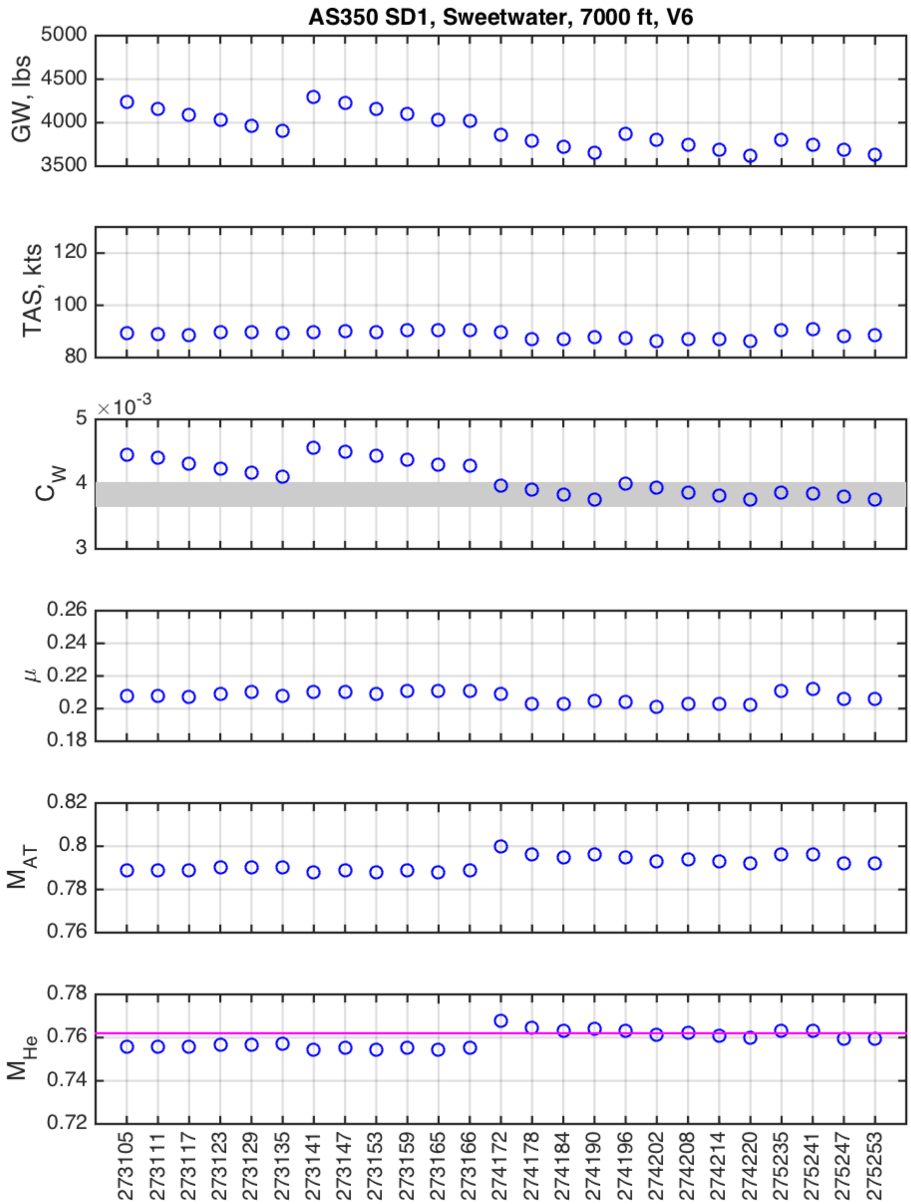


Figure 54: AS350 SD1 aircraft parameters for Sweetwater, 7000 ft, V6 test condition. Gray box is target C_W range. Magenta line is target M_{H_e}.

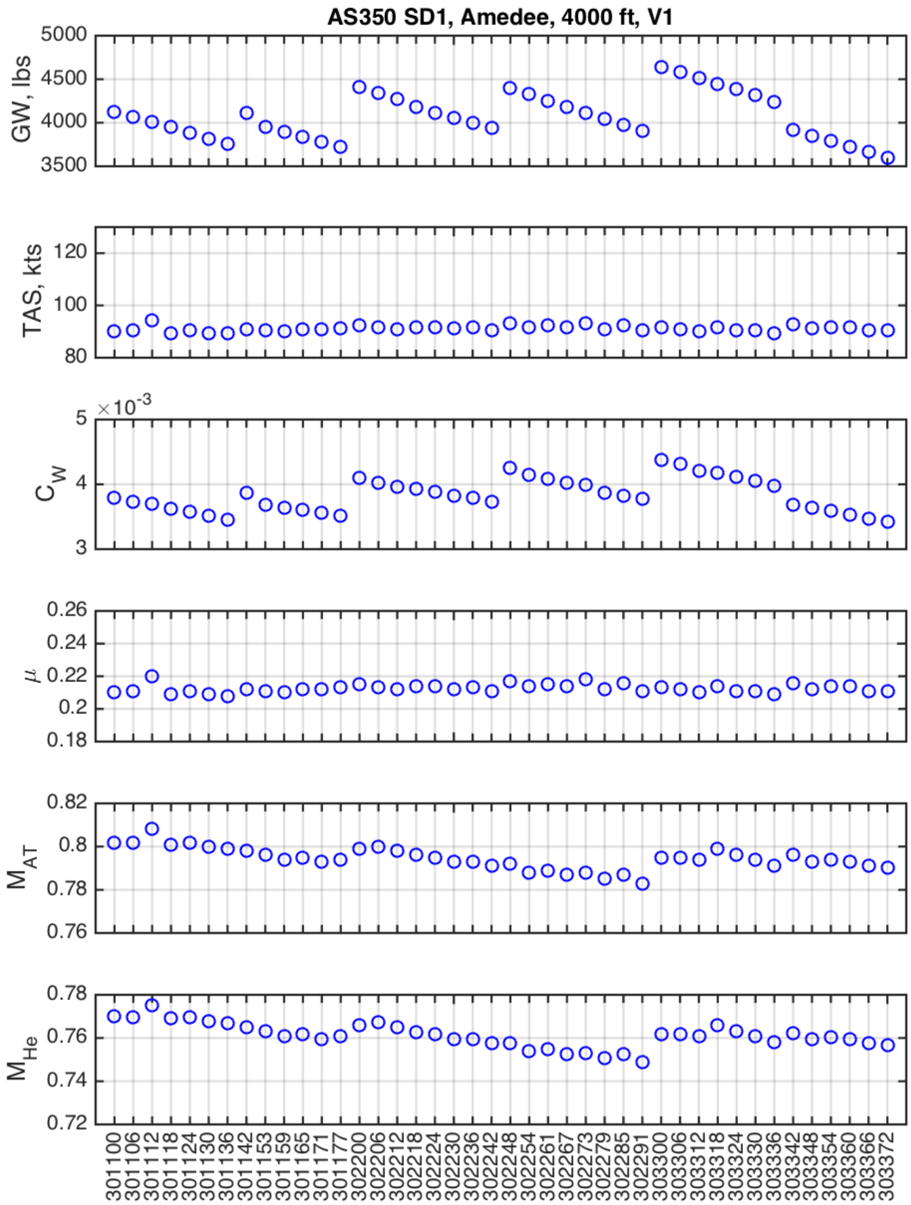


Figure 55: AS350 SD1 aircraft parameters for Amedee, 4000 ft, V1 test condition.

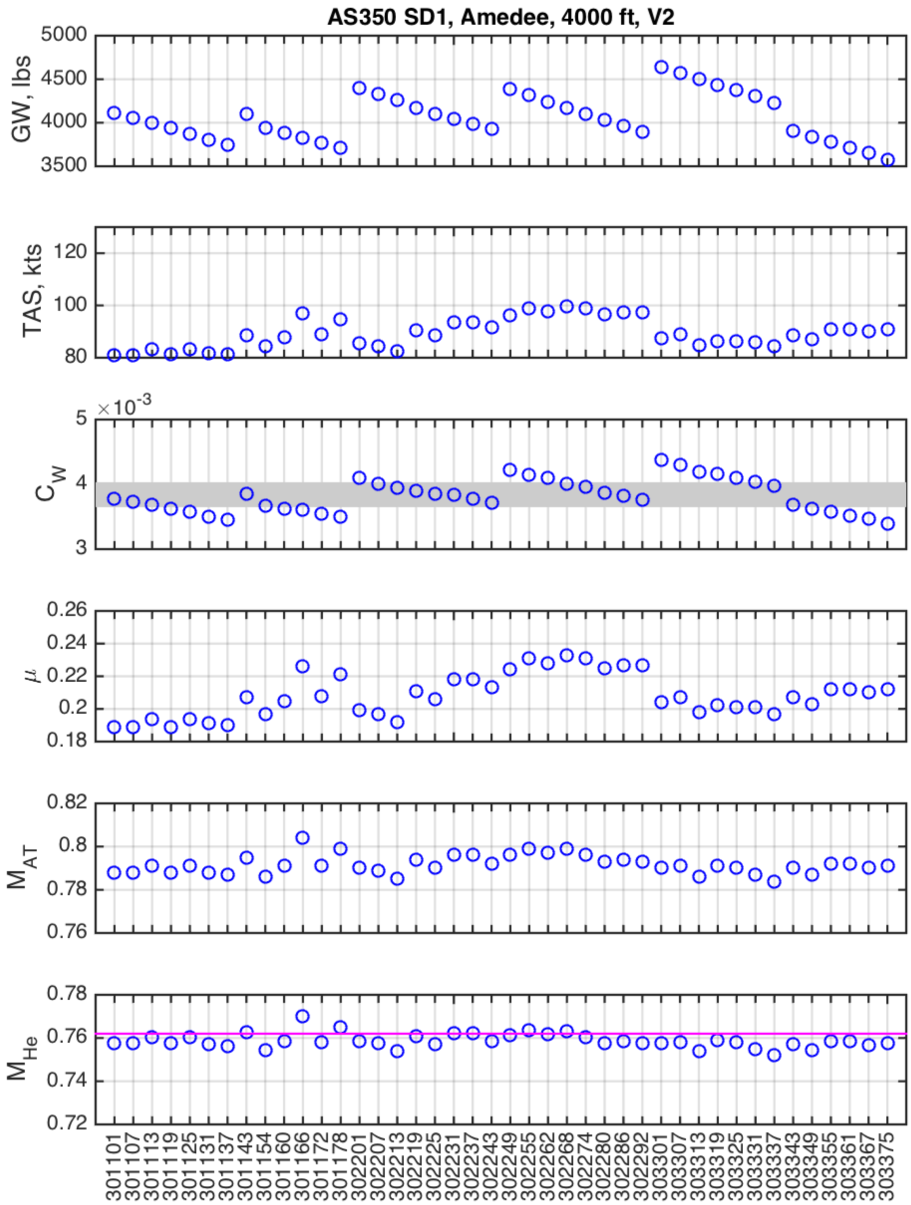


Figure 56: AS350 SD1 aircraft parameters for Amedee, 4000 ft, V2 test condition. Gray box is target C_W range. Magenta line is target M_{H_e}.

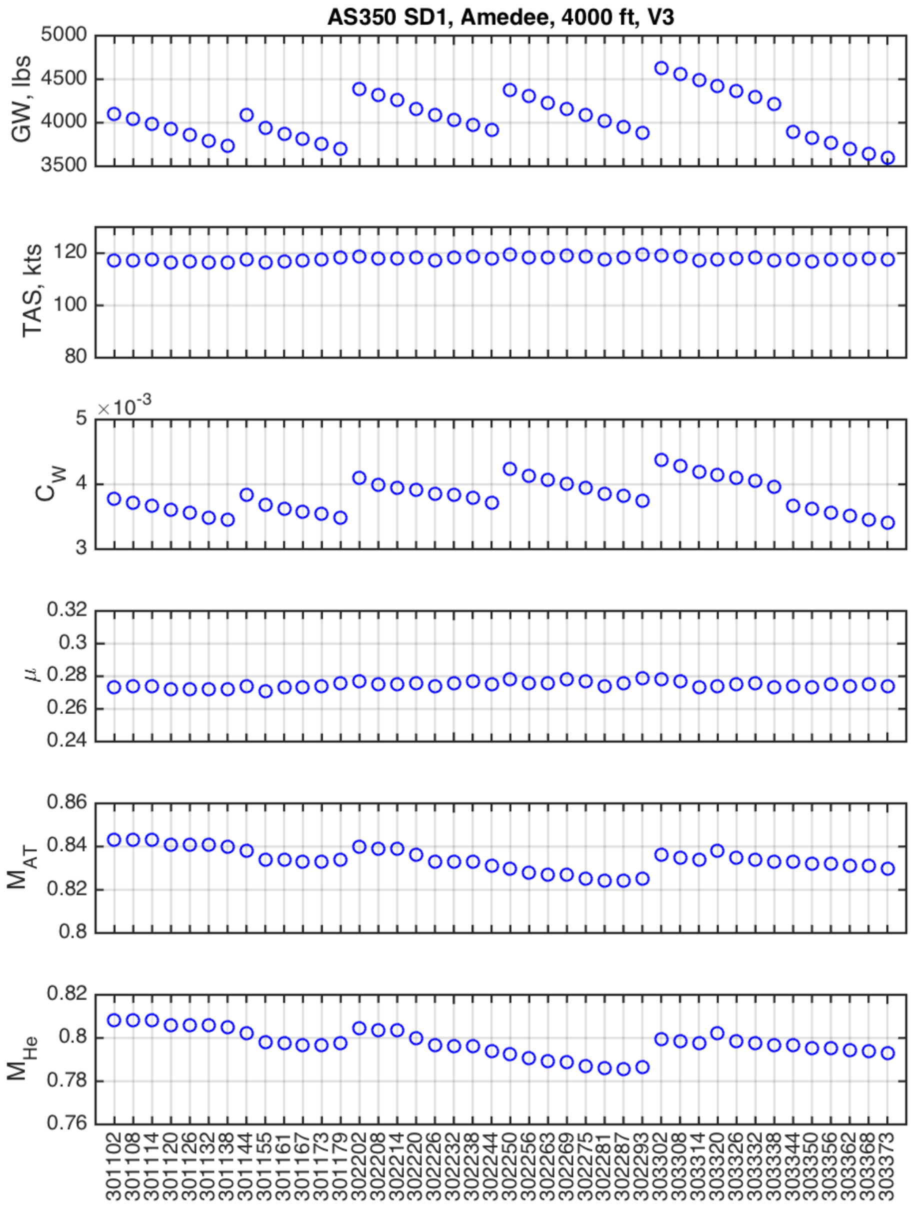


Figure 57: AS350 SD1 aircraft parameters for Amedee, 4000 ft, V3 test condition.

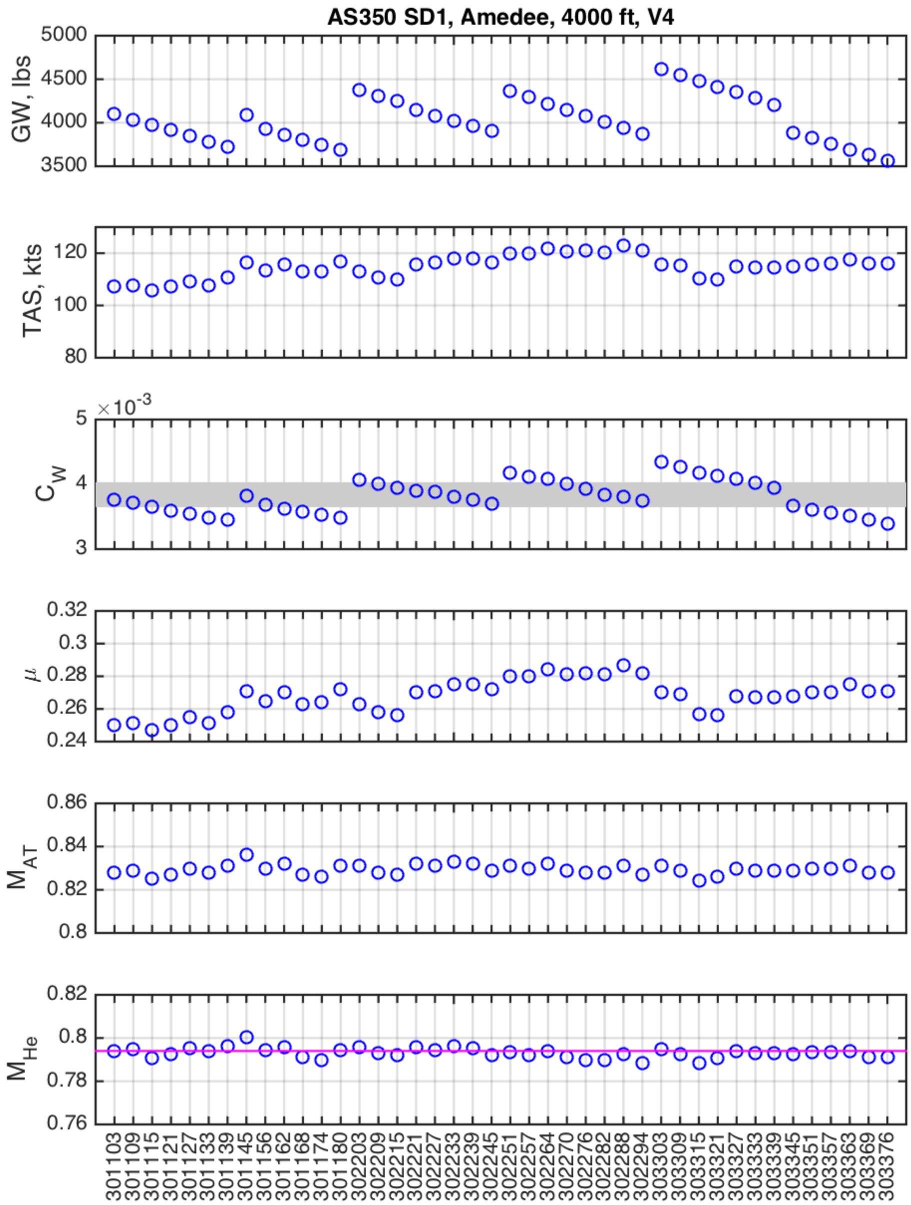


Figure 58: AS350 SD1 aircraft parameters for Amedee, 4000 ft, V4 test condition. Gray box is target C_W range. Magenta line is target M_{H_e}.

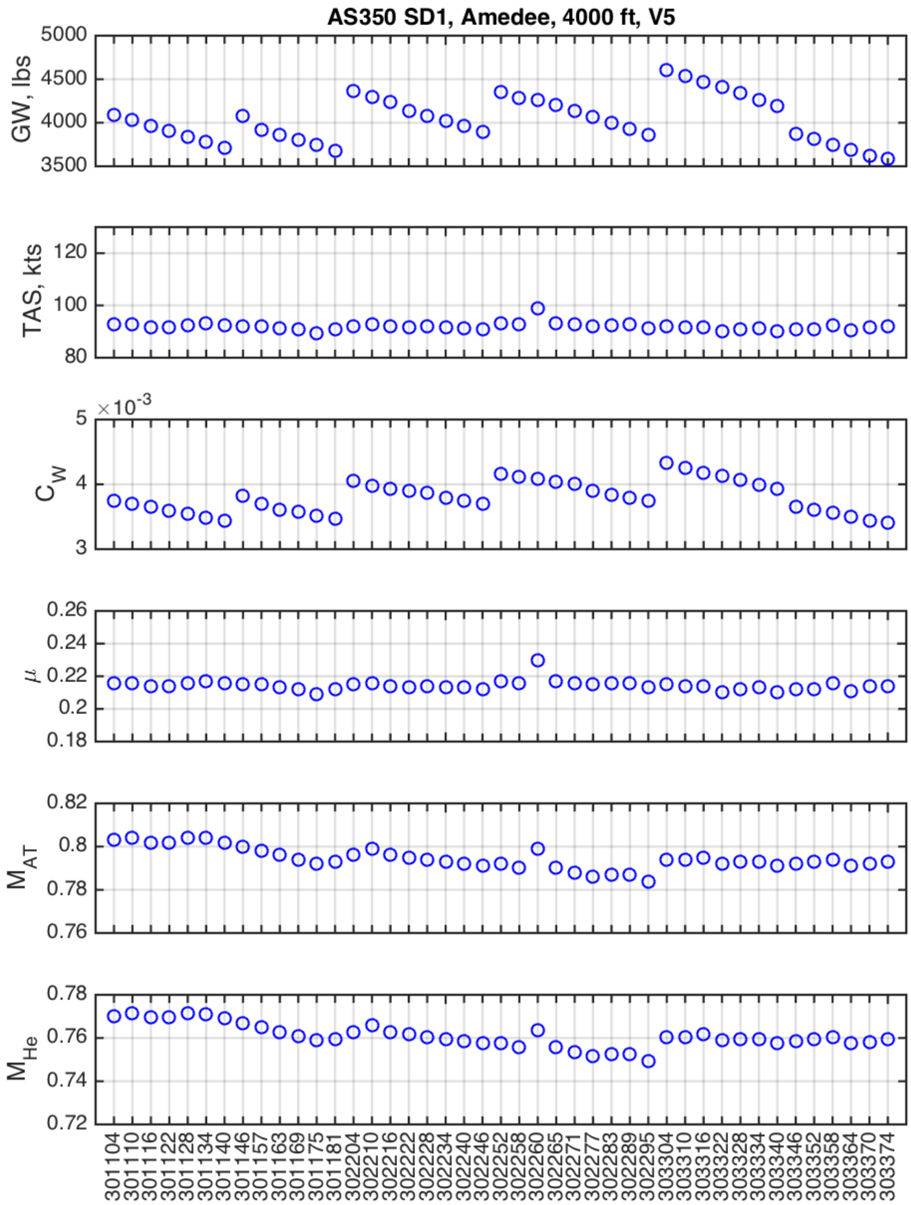


Figure 59: AS350 SD1 aircraft parameters for Amedee, 4000 ft, V5 test condition.

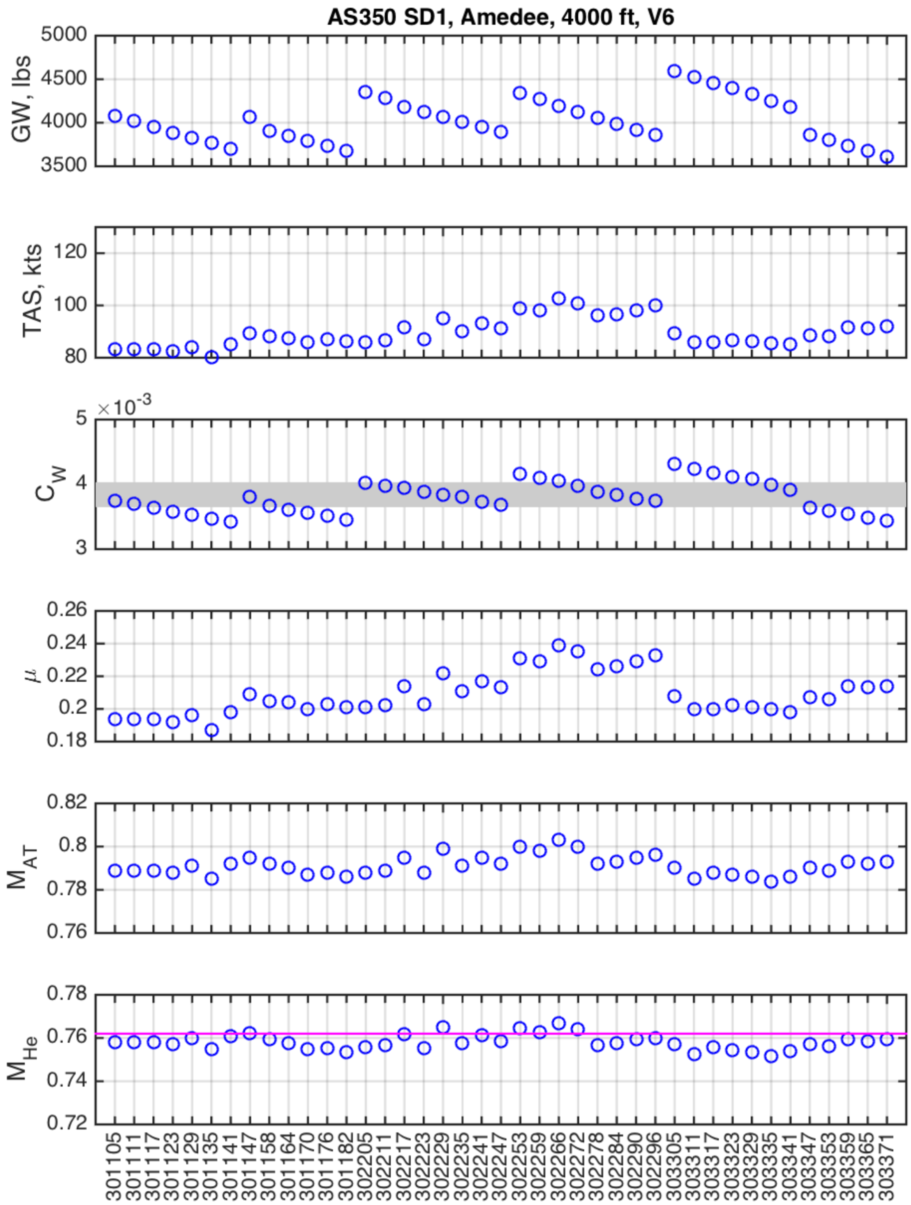


Figure 60: AS350 SD1 aircraft parameters for Amedee, 4000 ft, V6 test condition. Gray box is target C_W range. Magenta line is target M_{H_e}.

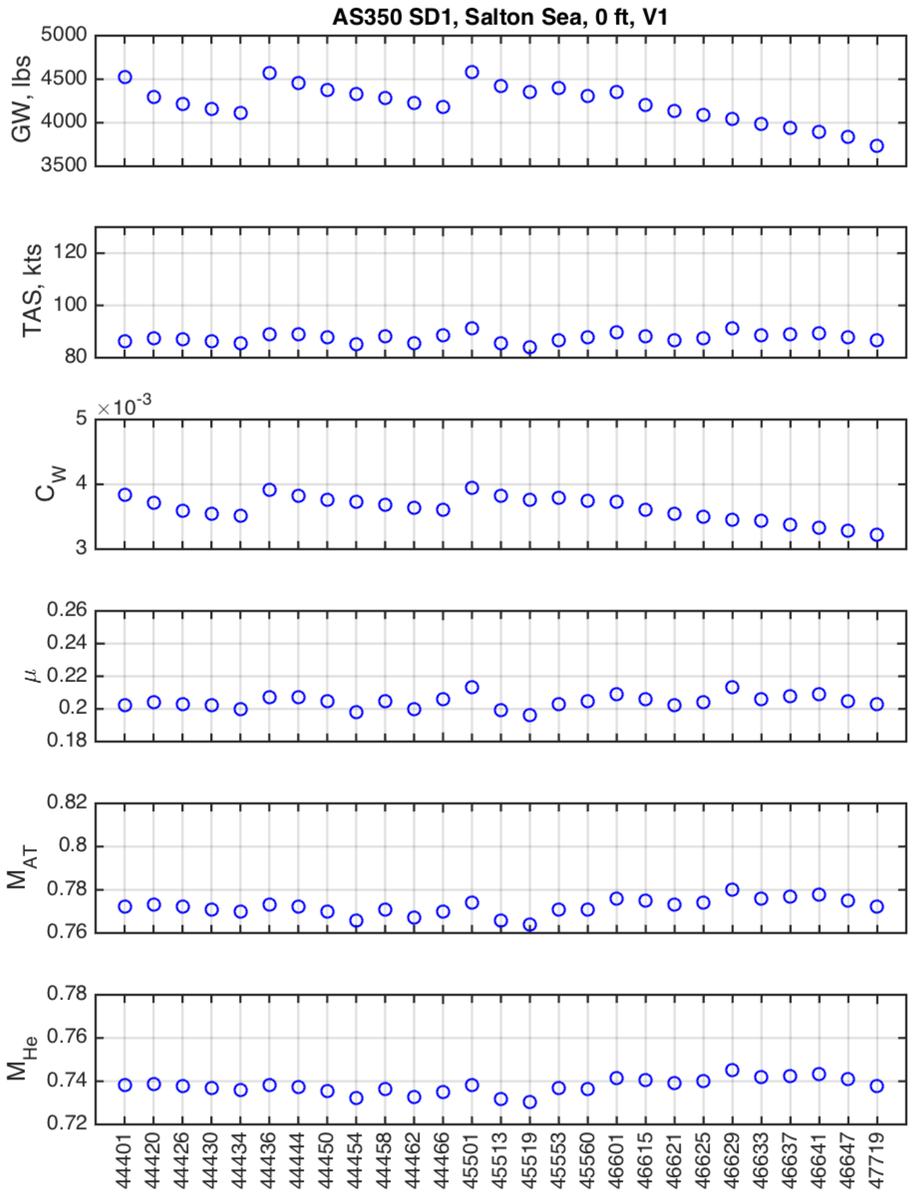


Figure 61: AS350 SD1 aircraft parameters for Salton Sea, 0 ft, V1 test condition.

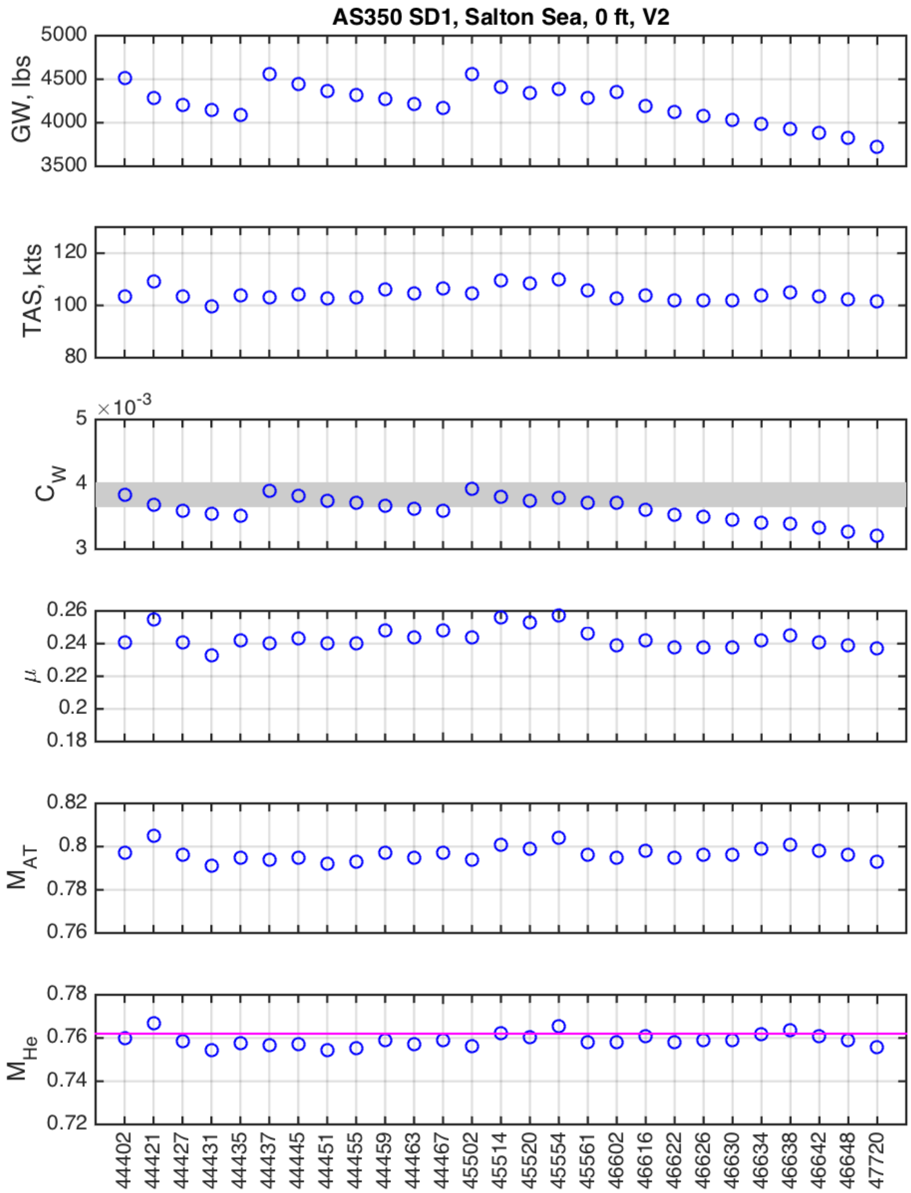


Figure 62: AS350 SD1 aircraft parameters for Salton Sea, 0 ft, V2 test condition. Gray box is target C_W range. Magenta line is target M_{H_e}.

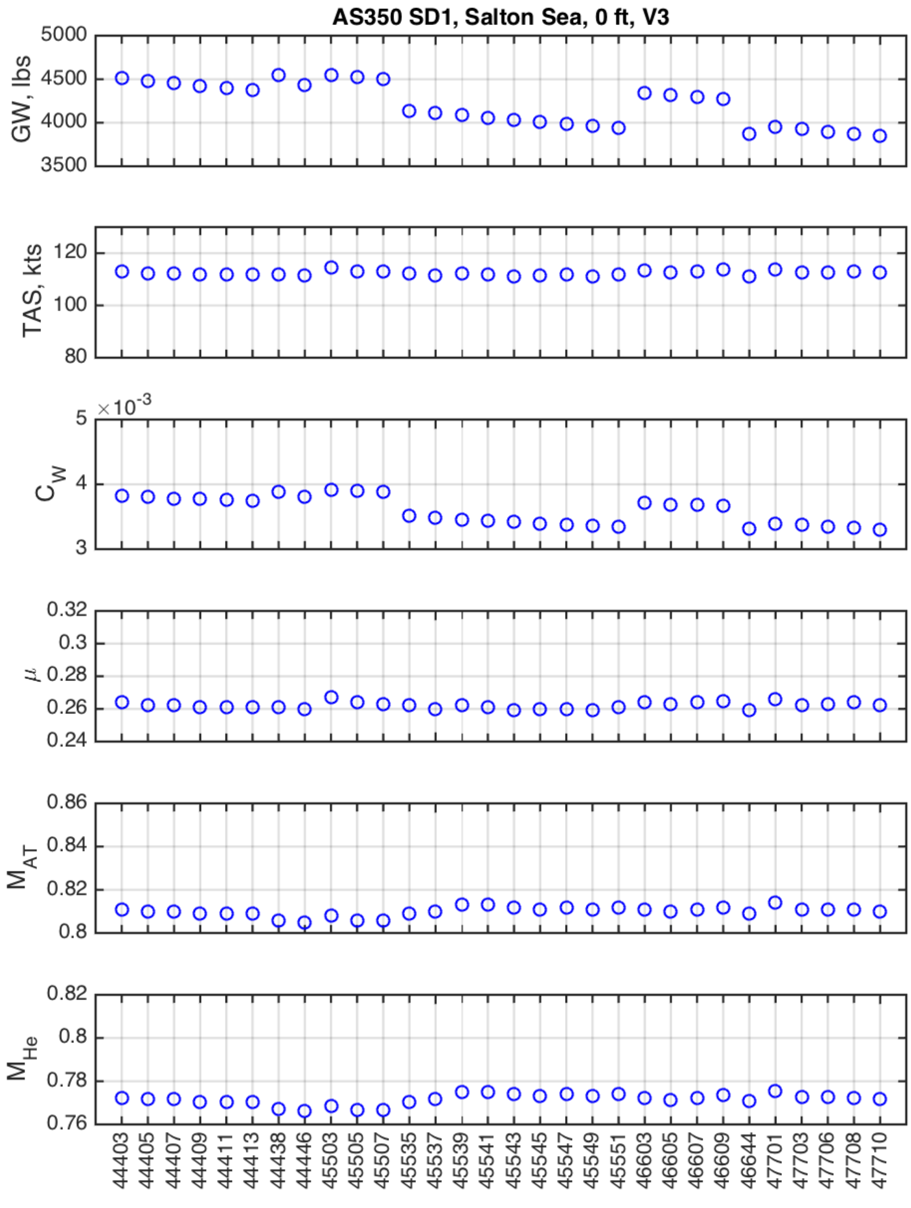


Figure 63: AS350 SD1 aircraft parameters for Salton Sea, 0 ft, V3 test condition.

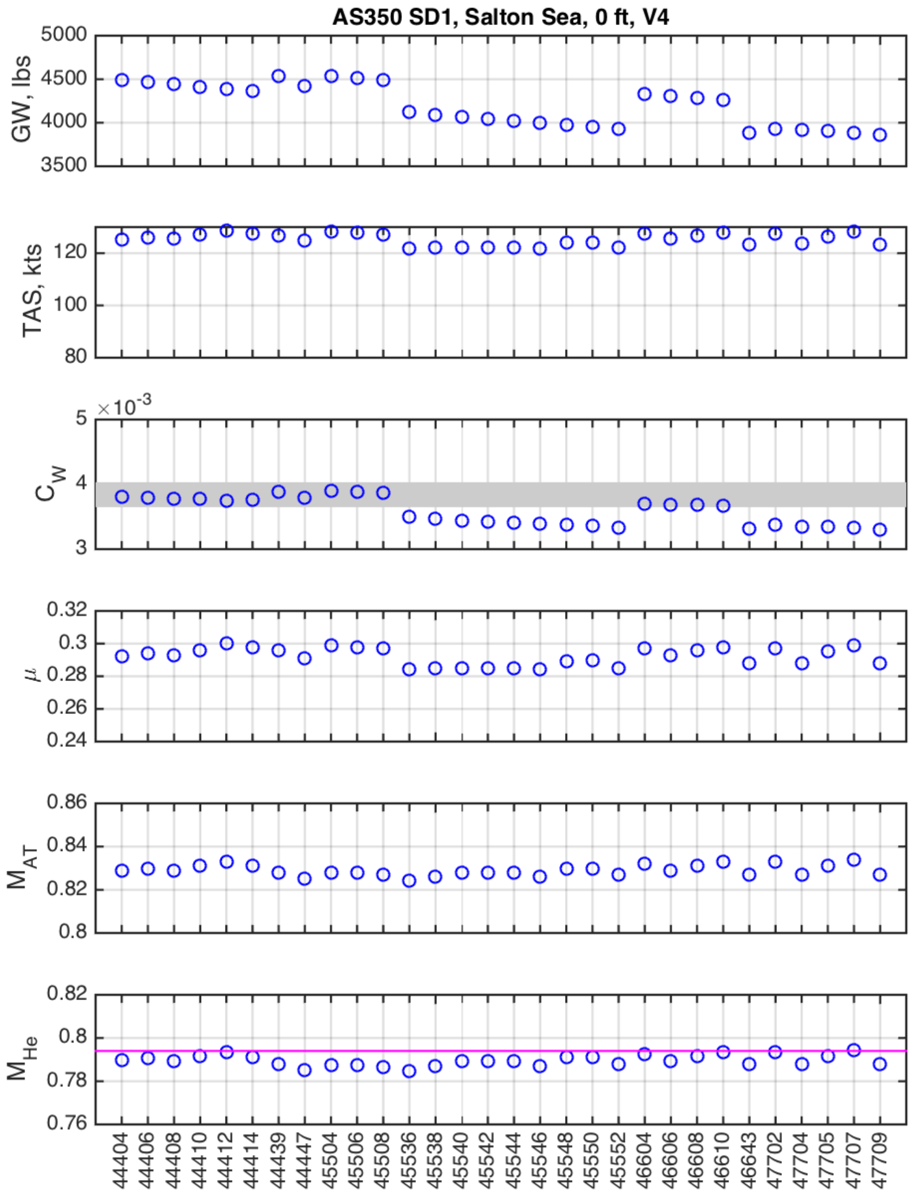


Figure 64: AS350 SD1 aircraft parameters for Salton Sea, 0 ft, V4 test condition. Gray box is target C_W range. Magenta line is target M_{H_e}.

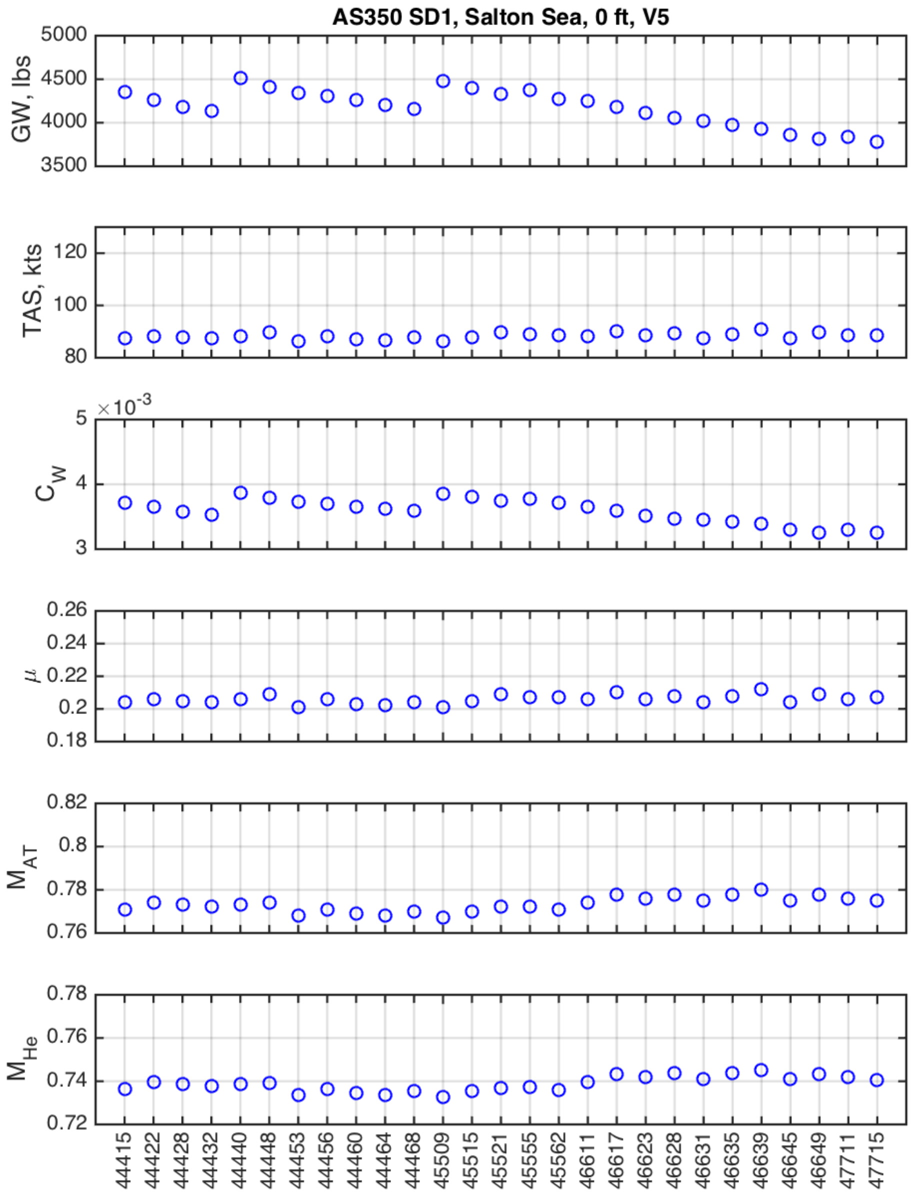


Figure 65: AS350 SD1 aircraft parameters for Salton Sea, 0 ft, V5 test condition.

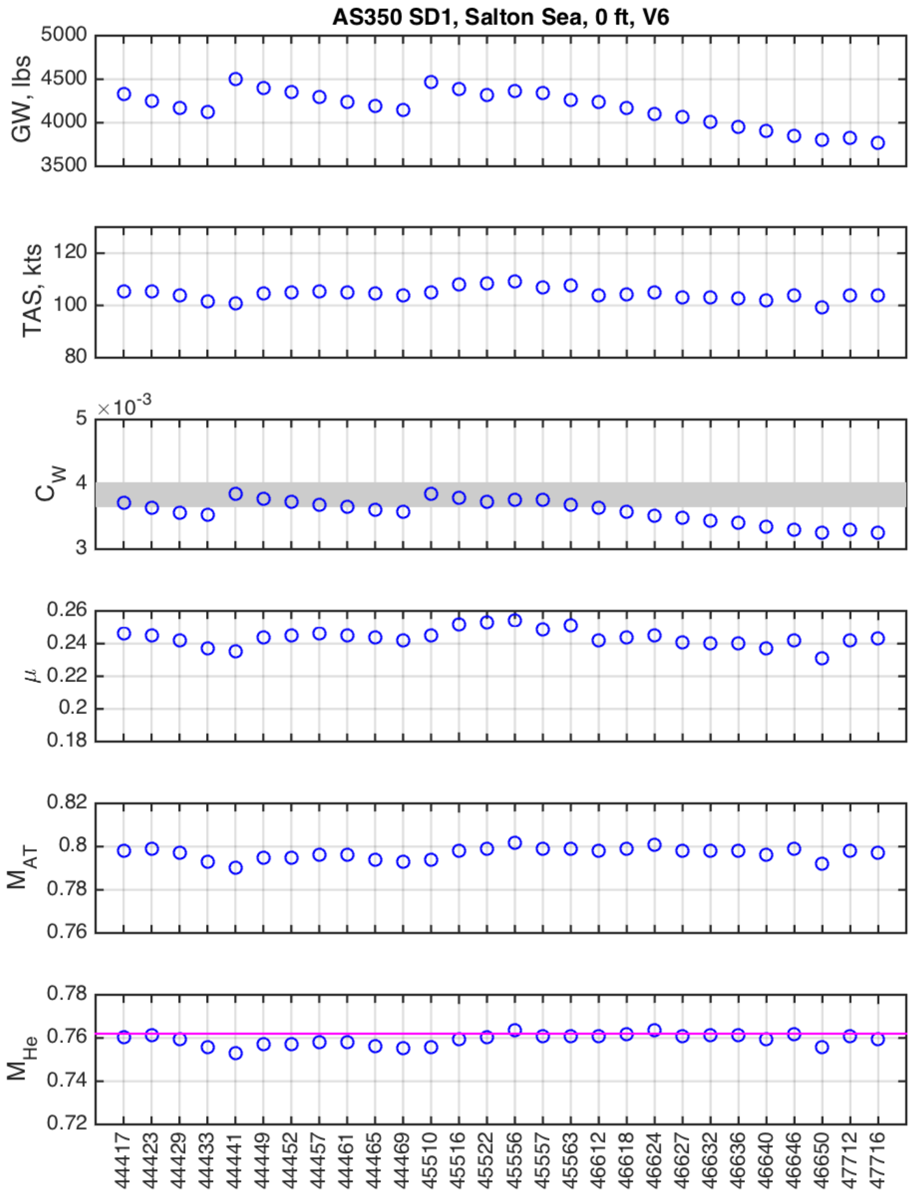


Figure 66: AS350 SD1 aircraft parameters for Salton Sea, 0 ft, V6 test condition. Gray box is target C_W range. Magenta line is target M_{H_e}.

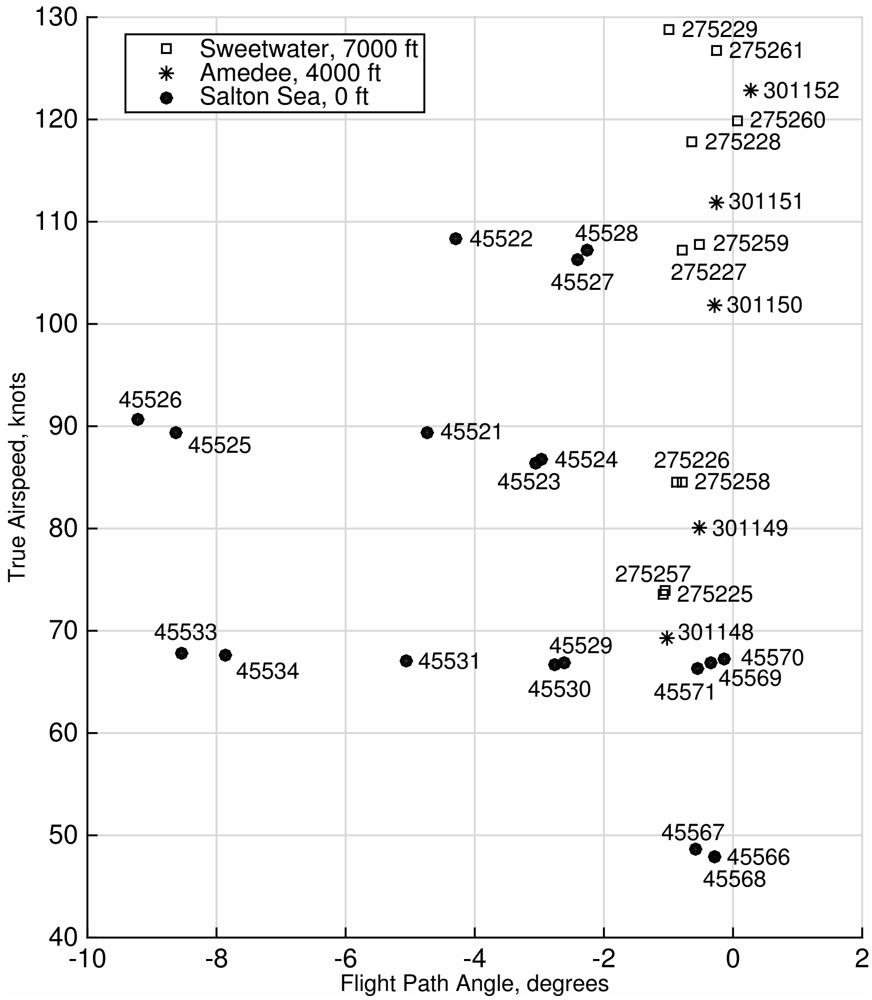


Figure 67: True airspeed vs flight path angle for AS350 SD1 A and L conditions.

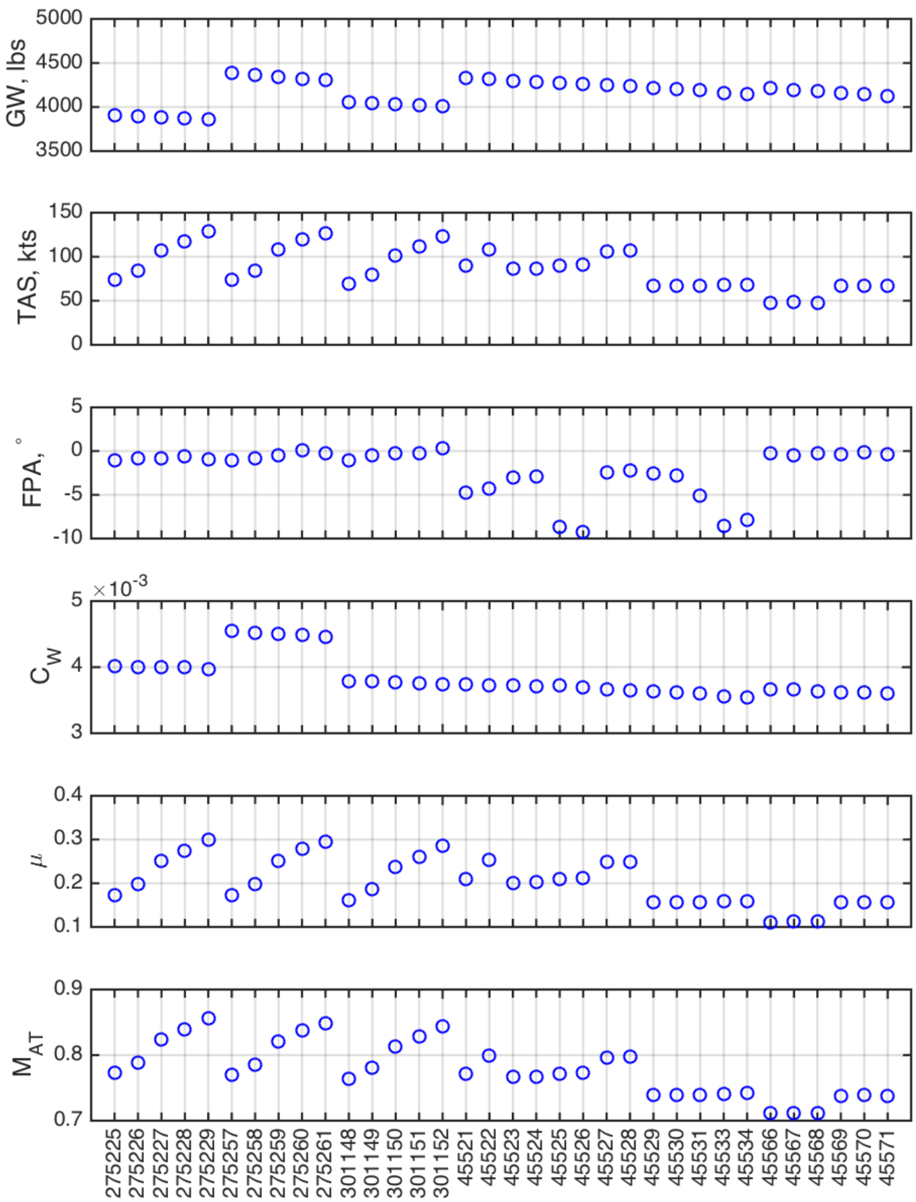
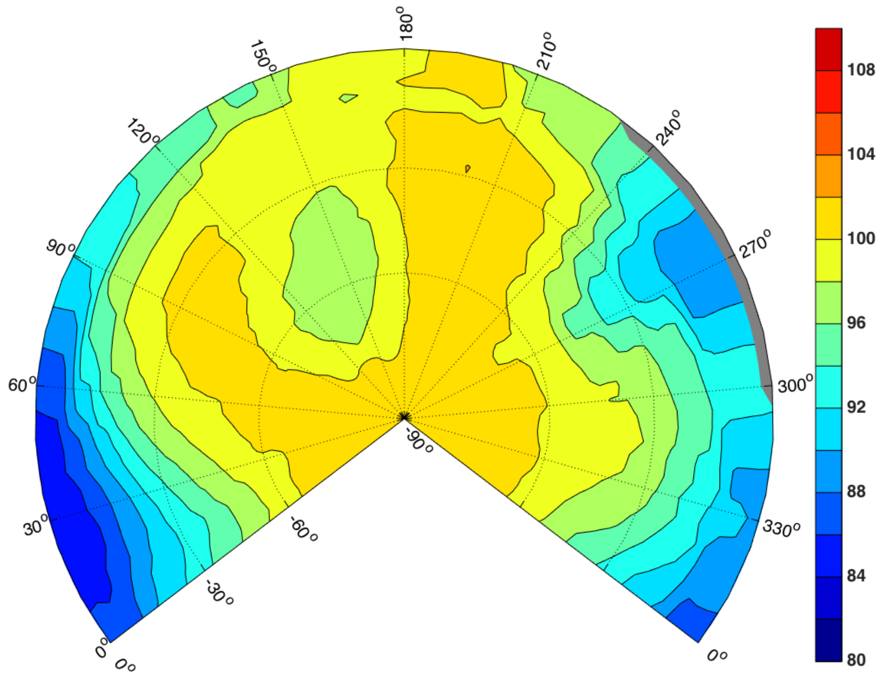
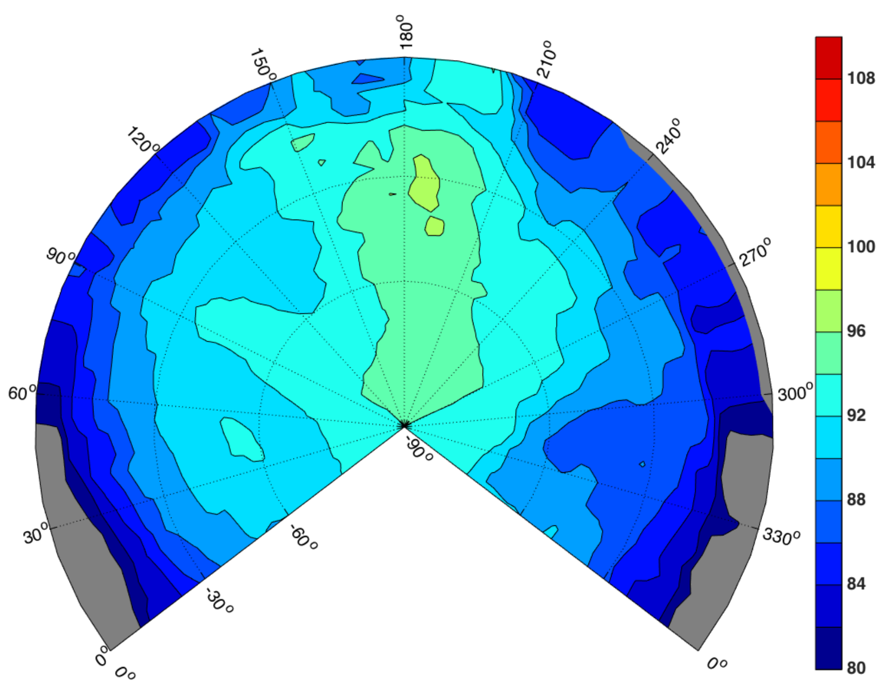


Figure 68: AS350 SD1 A and L condition aircraft parameters.

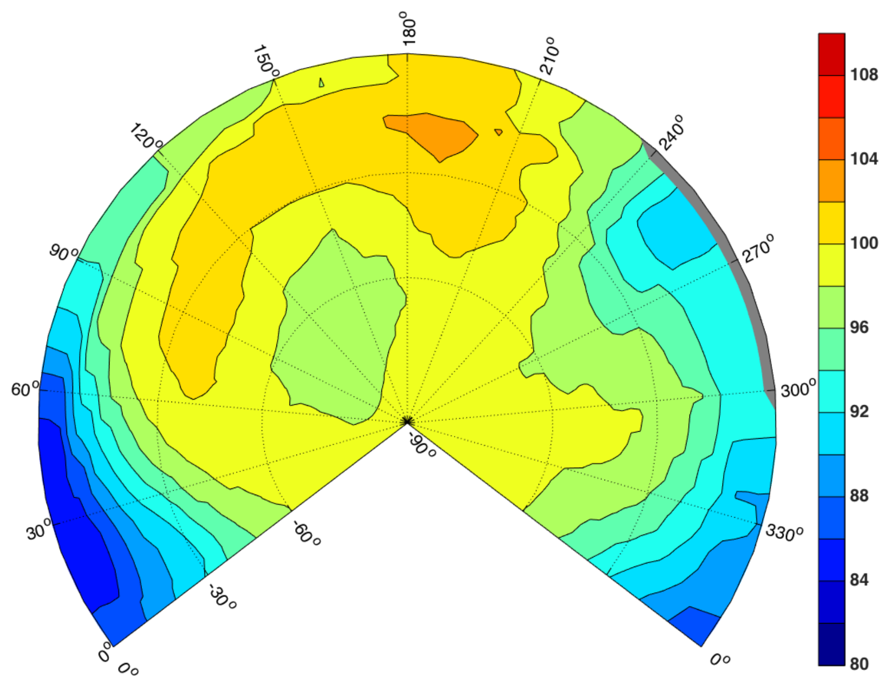


(a) OASPL, 0 to 6000 Hz, decibels.

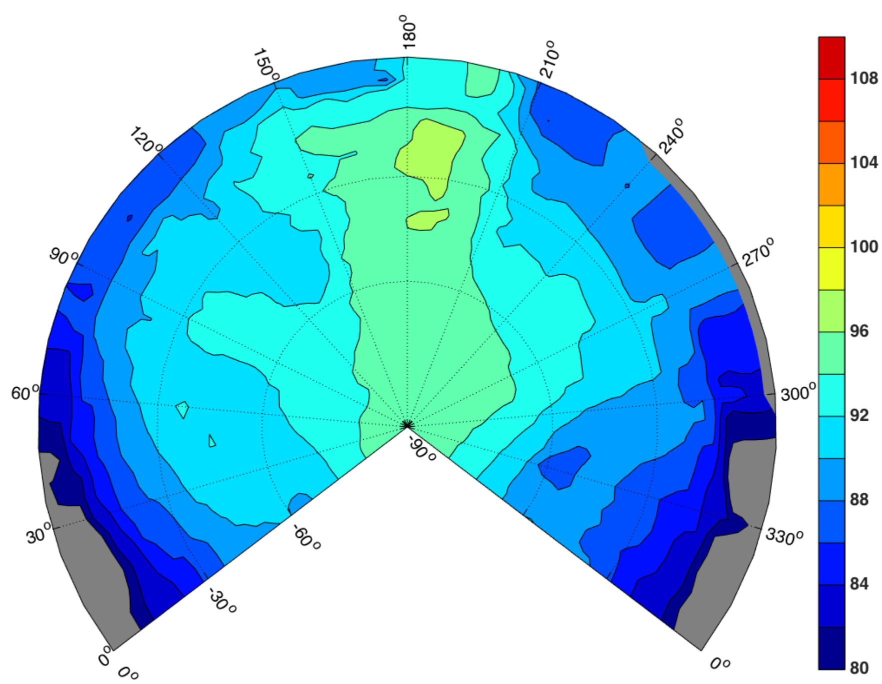


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 69: AS350 SD1 hemispheres for run number 275225, normalized, 73.6 KTAS, -1.1° FPA.

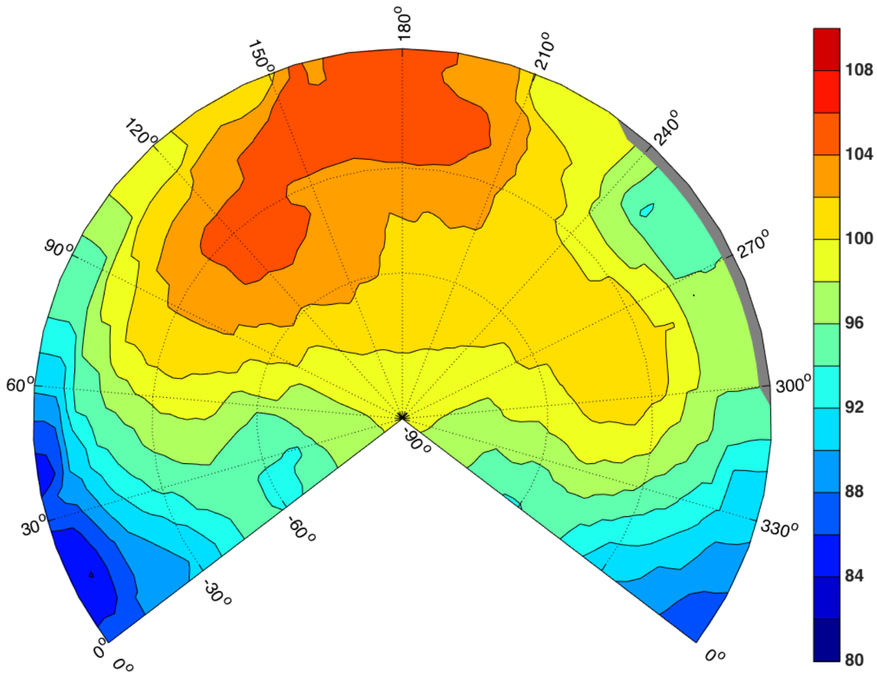


(a) OASPL, 0 to 6000 Hz, decibels.

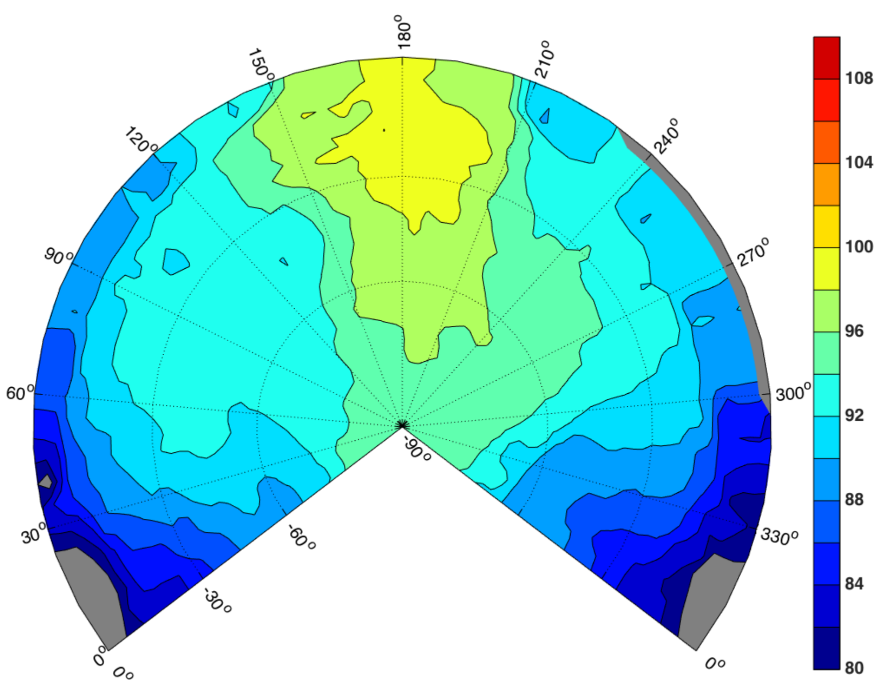


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 70: AS350 SD1 hemispheres for run number 275226, normalized, 84.6 KTAS, -0.9° FPA.

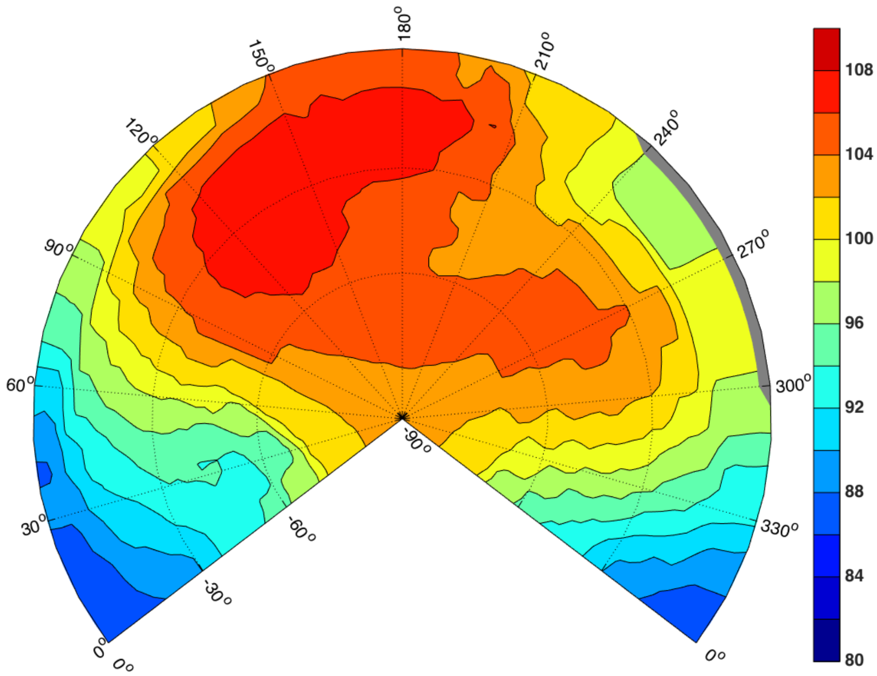


(a) OASPL, 0 to 6000 Hz, decibels.

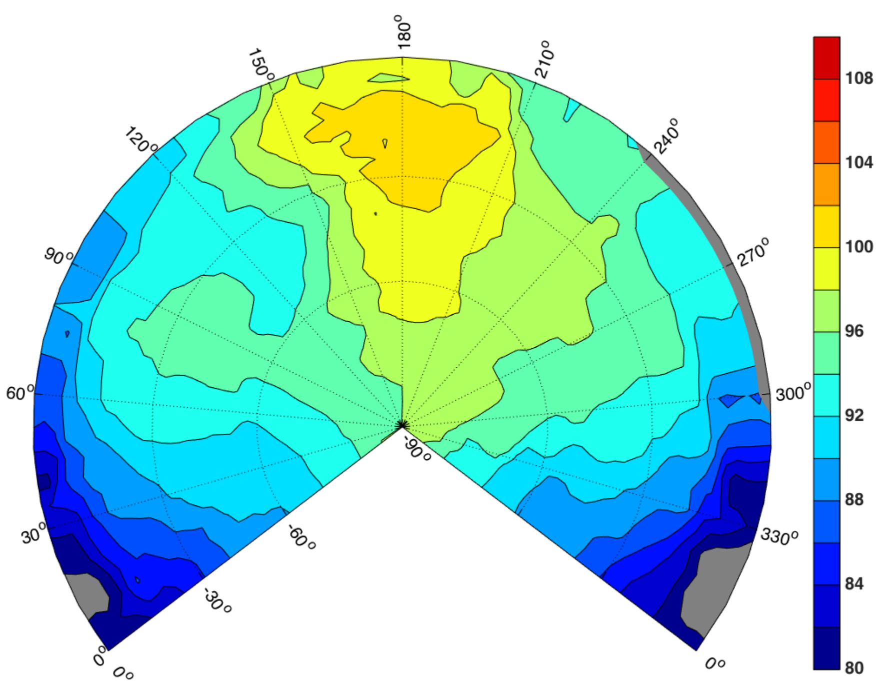


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 71: AS350 SD1 hemispheres for run number 275227, normalized, 107.2 KTAS, -0.8° FPA.

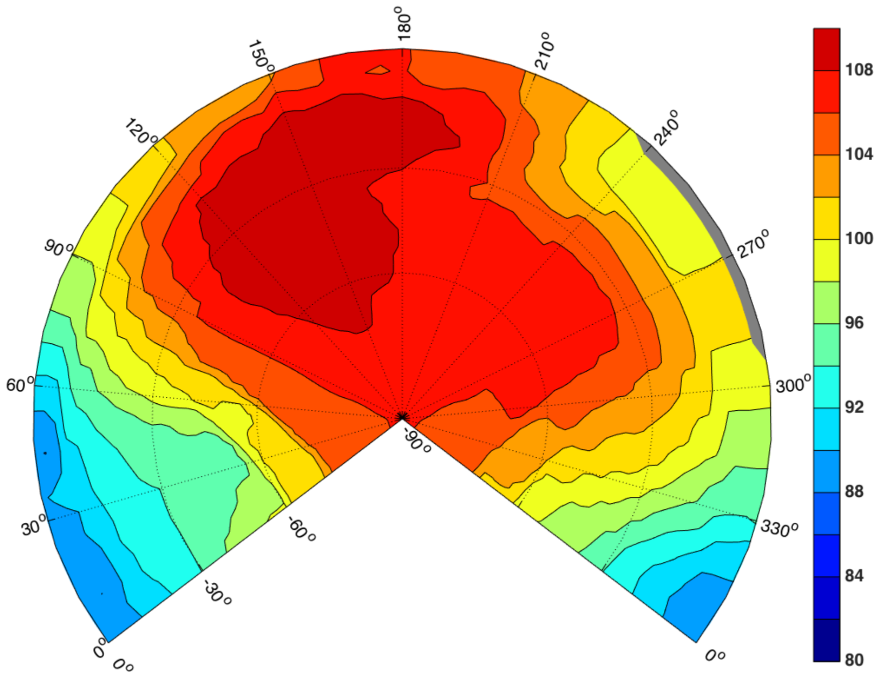


(a) OASPL, 0 to 6000 Hz, decibels.

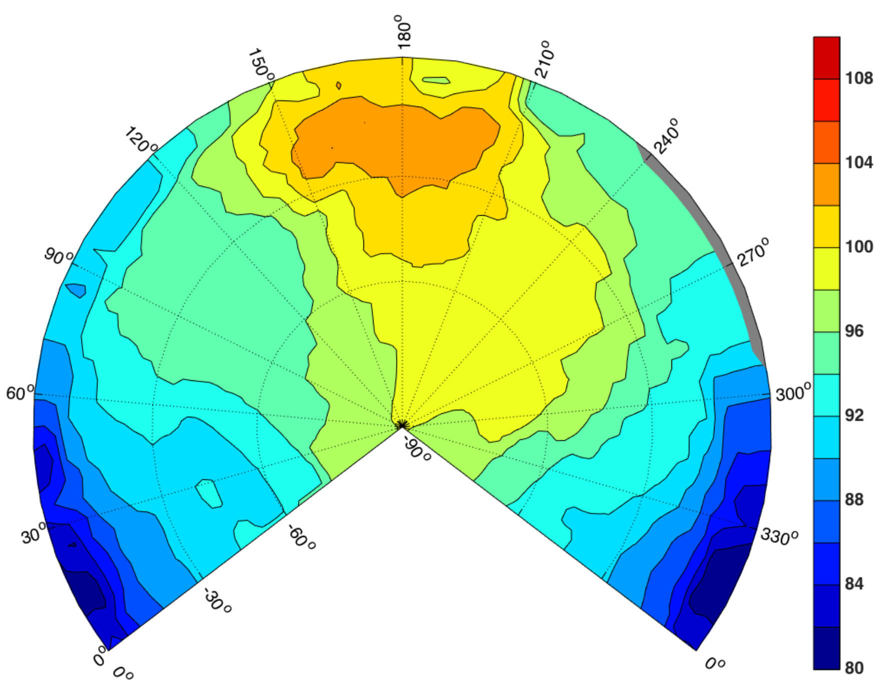


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 72: AS350 SD1 hemispheres for run number 275228, normalized, 117.8 KTAS, -0.6° FPA.

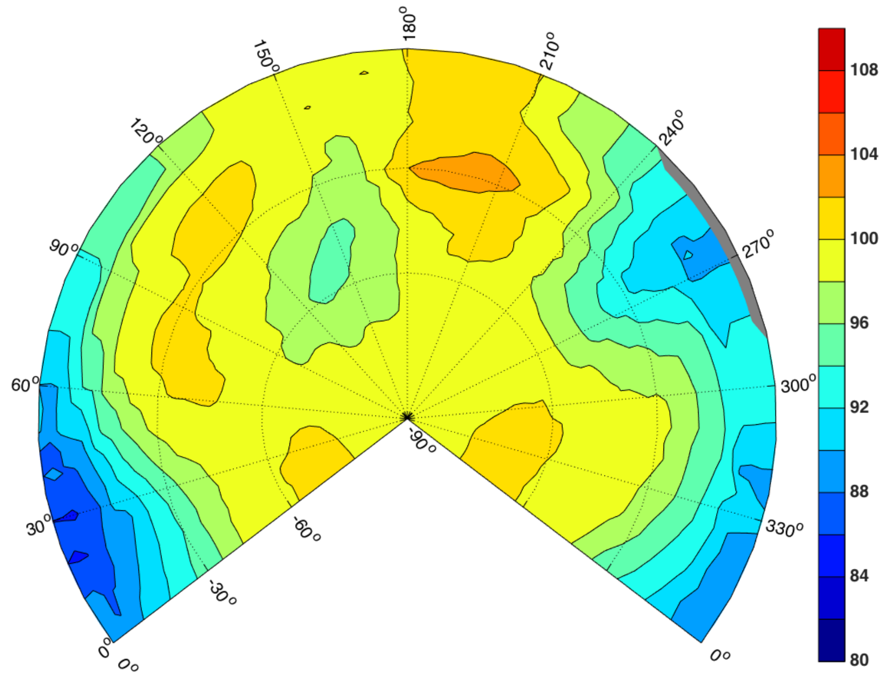


(a) OASPL, 0 to 6000 Hz, decibels.

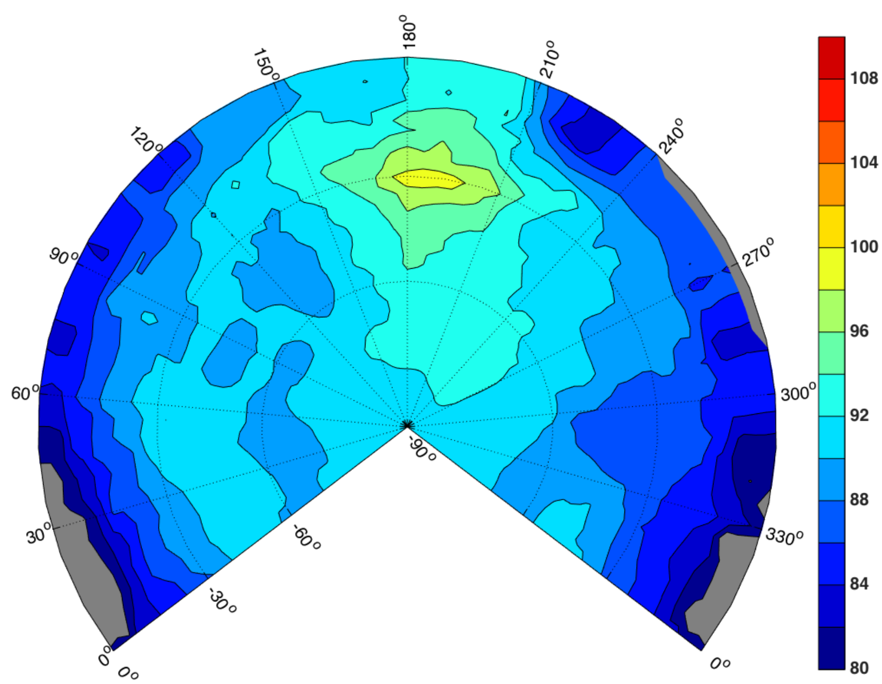


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 73: AS350 SD1 hemispheres for run number 275229, normalized, 128.8 KTAS, -1.0° FPA.

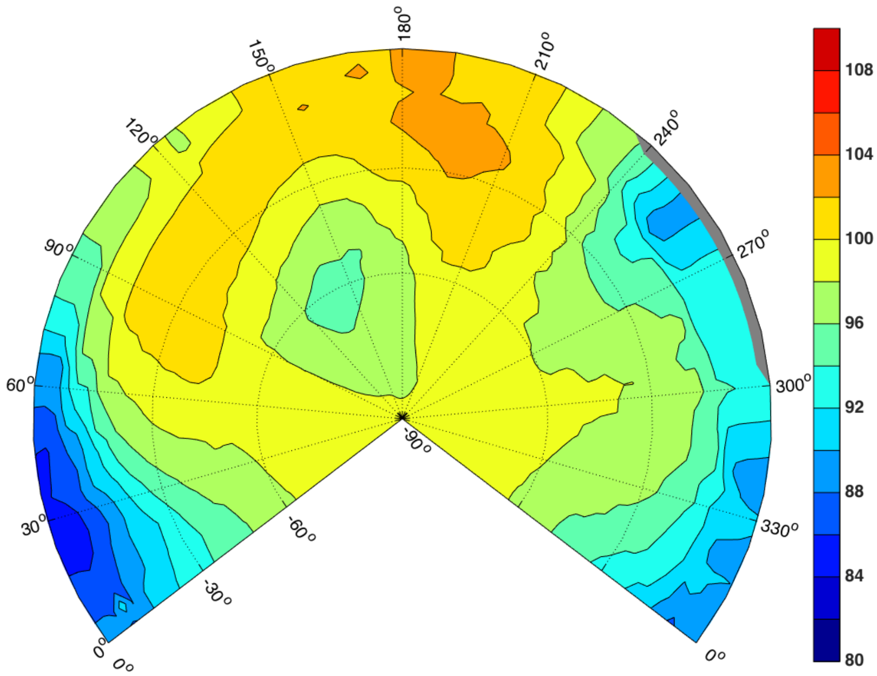


(a) OASPL, 0 to 6000 Hz, decibels.

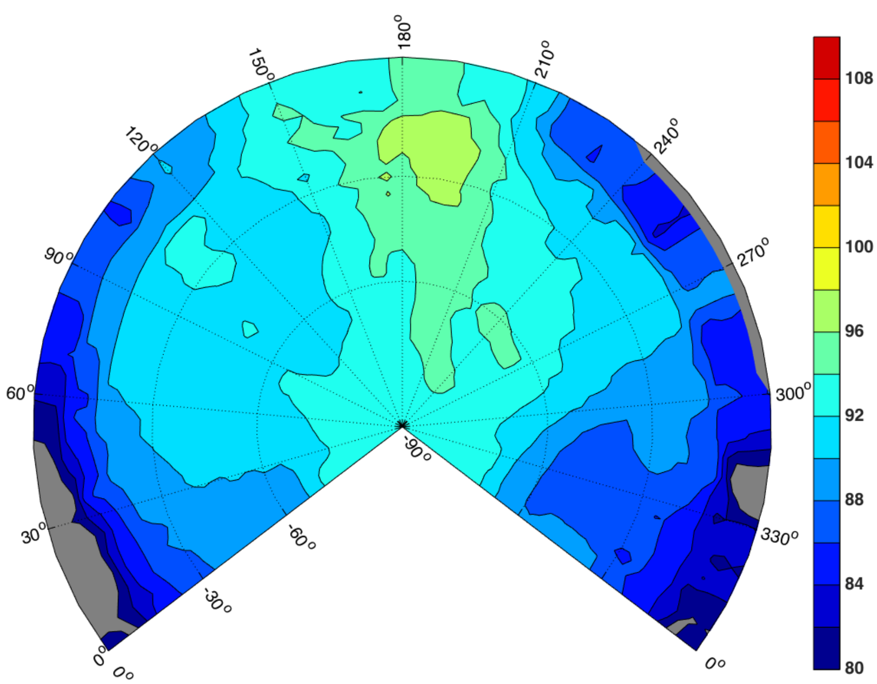


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 74: AS350 SD1 hemispheres for run number 275257, normalized, 74.0 KTAS, -1.1° FPA.

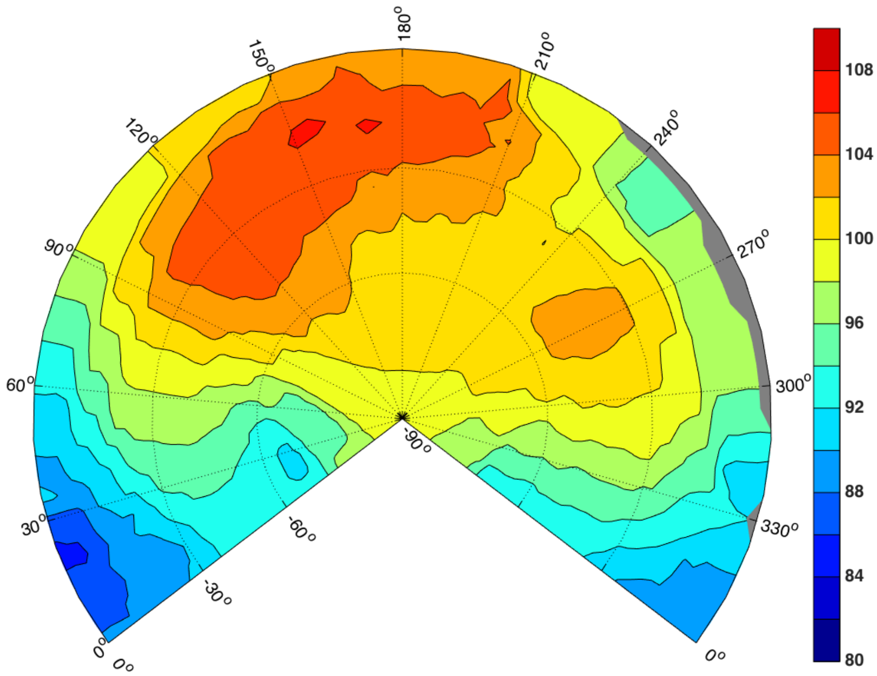


(a) OASPL, 0 to 6000 Hz, decibels.

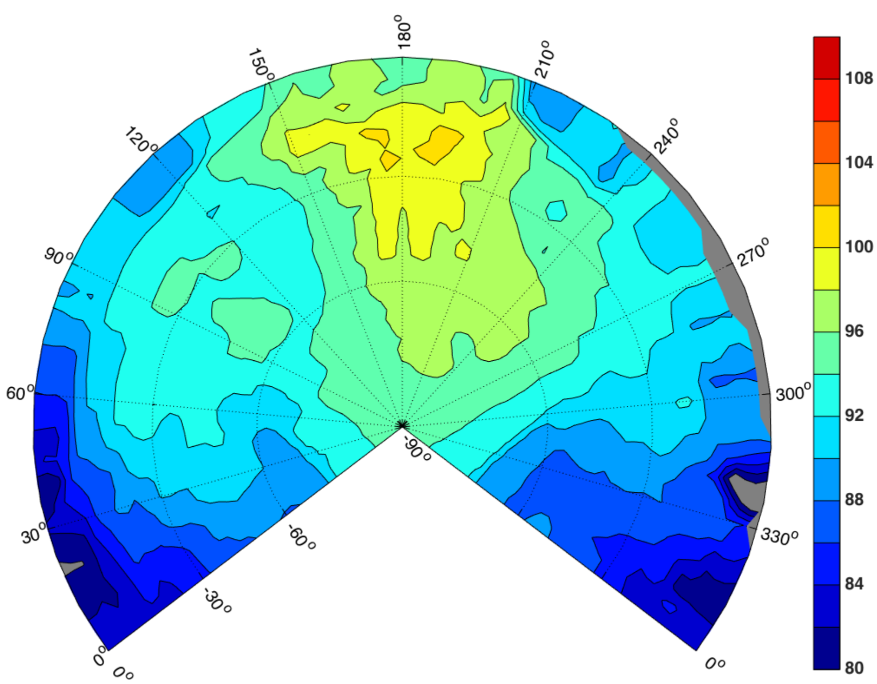


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 75: AS350 SD1 hemispheres for run number 275258, normalized, 84.5 KTAS, -0.8° FPA.

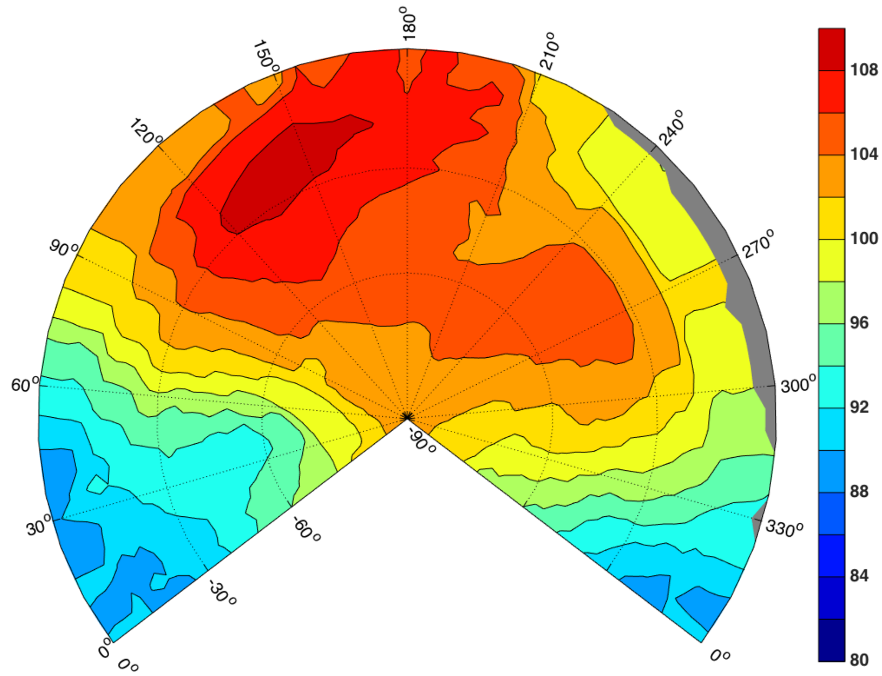


(a) OASPL, 0 to 6000 Hz, decibels.

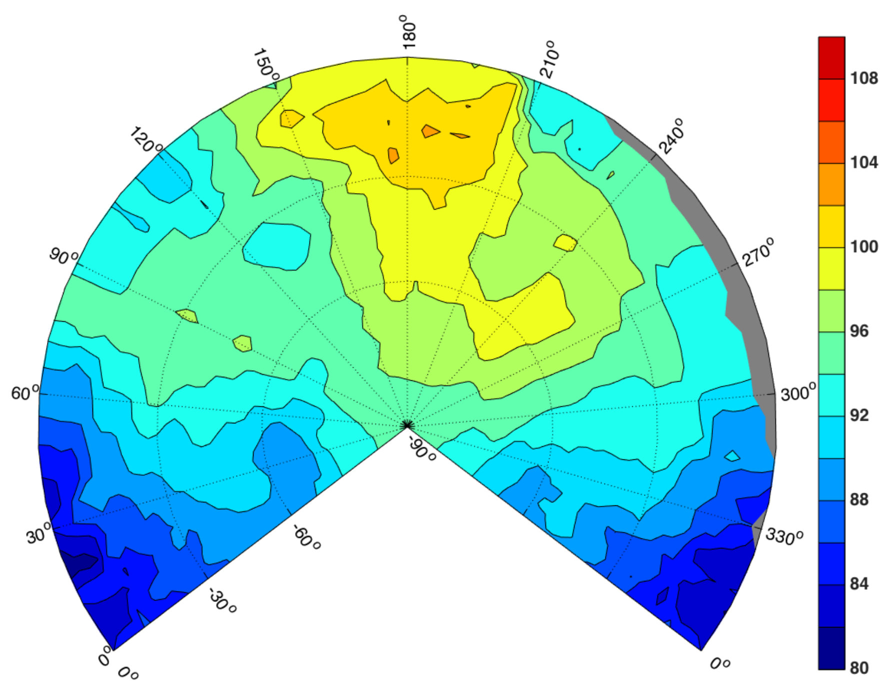


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 76: AS350 SD1 hemispheres for run number 275259, normalized, 107.8 KTAS, -0.5° FPA.

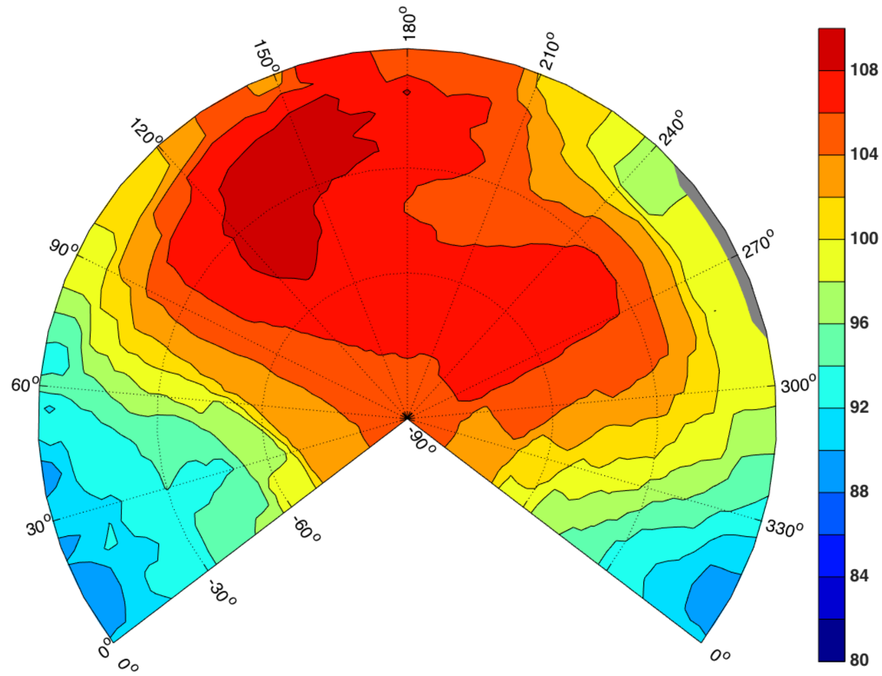


(a) OASPL, 0 to 6000 Hz, decibels.

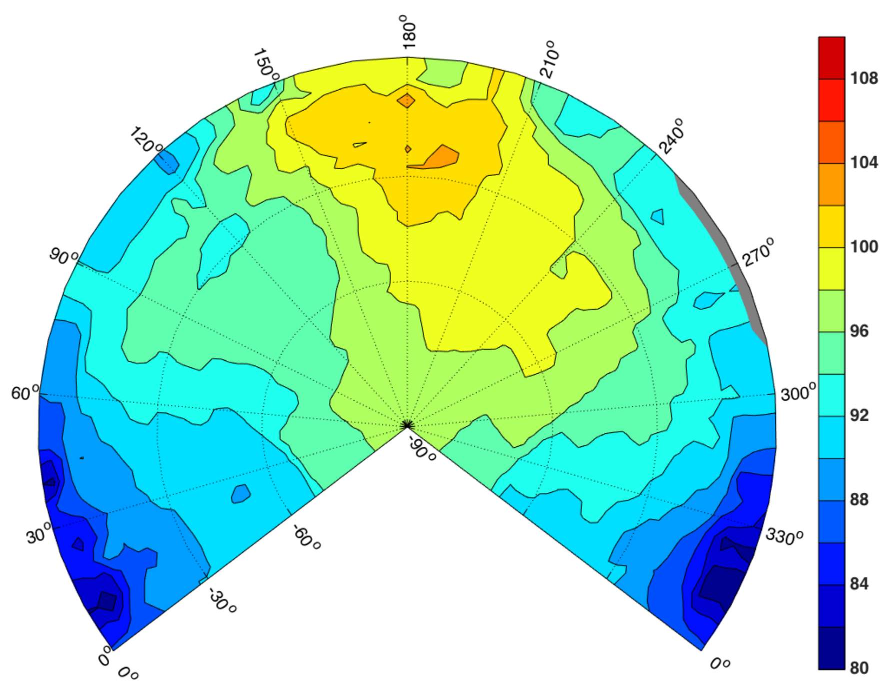


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 77: AS350 SD1 hemispheres for run number 275260, normalized, 119.9 KTAS, 0.1° FPA.

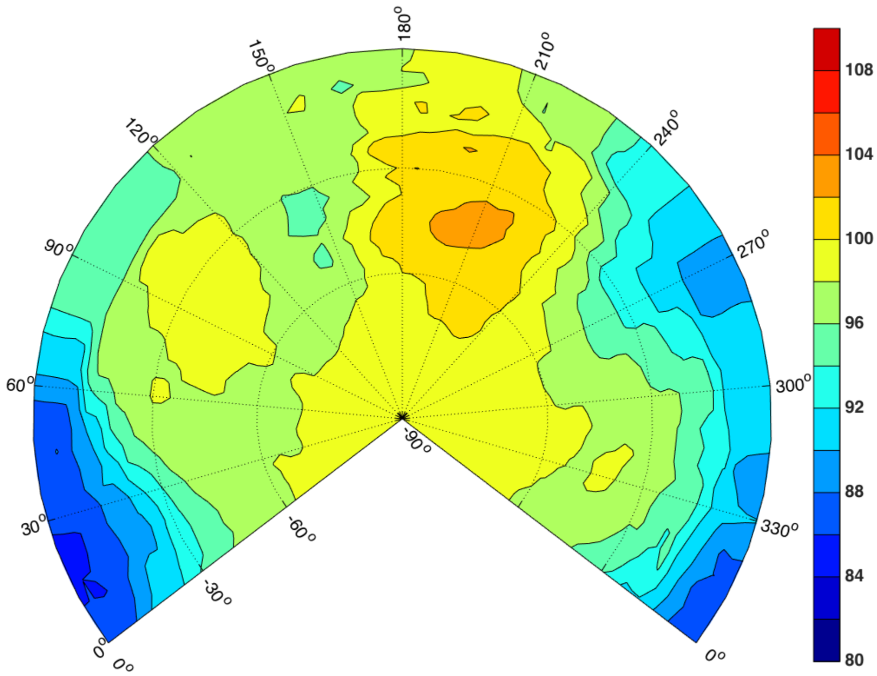


(a) OASPL, 0 to 6000 Hz, decibels.

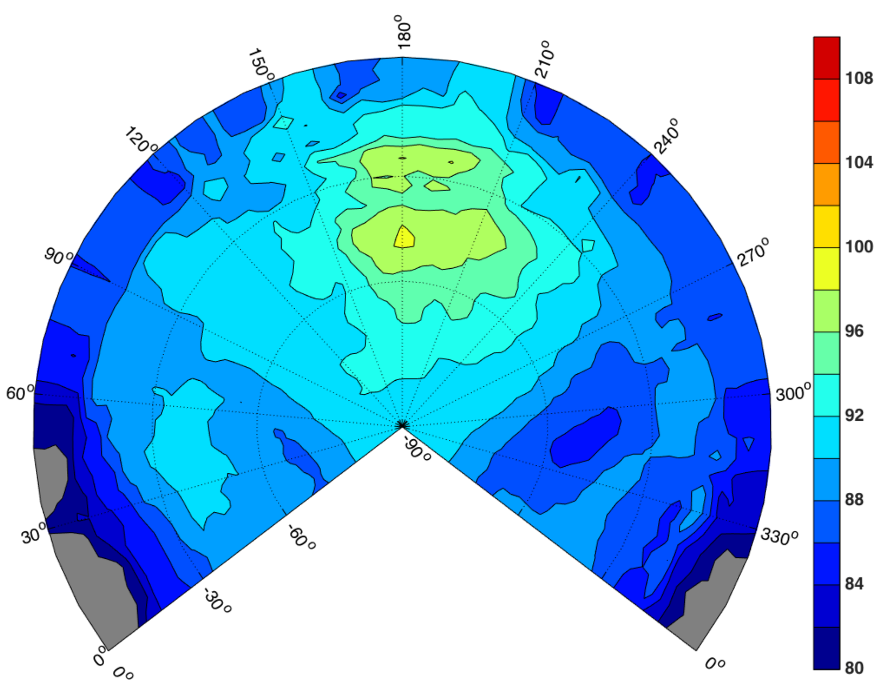


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 78: AS350 SD1 hemispheres for run number 275261, normalized, 126.7 KTAS, -0.3° FPA.

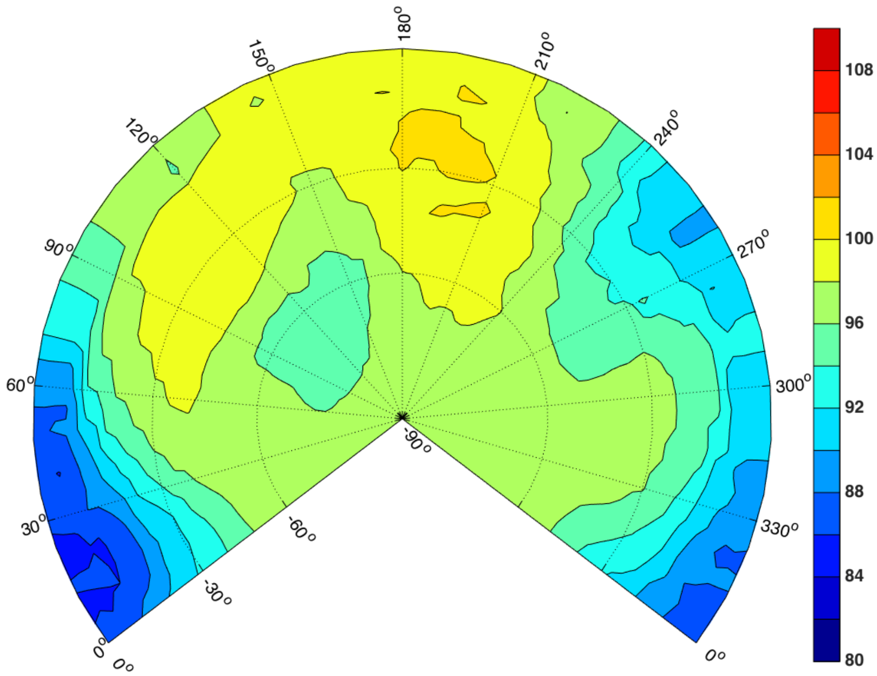


(a) OASPL, 0 to 6000 Hz, decibels.

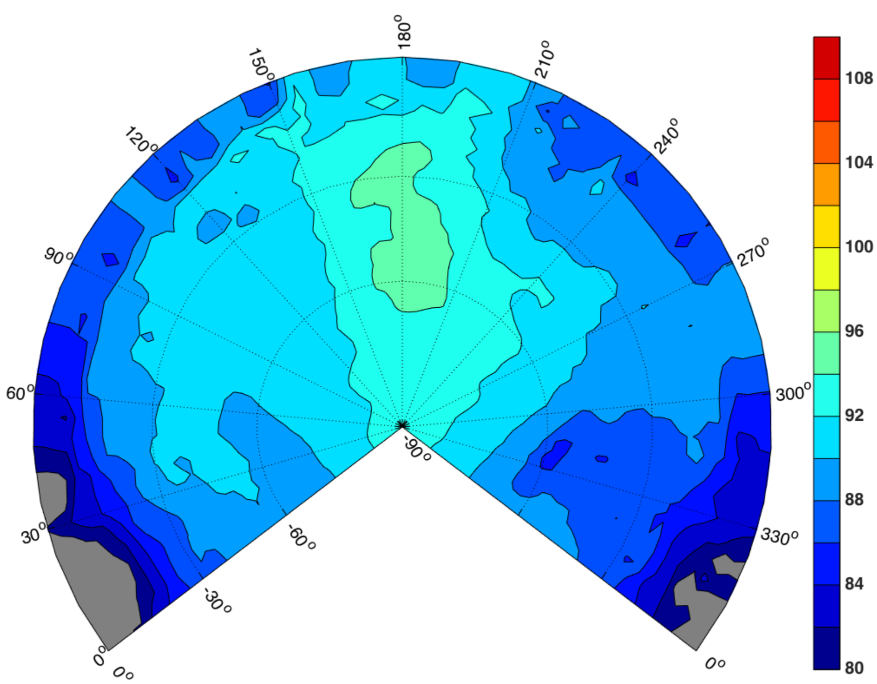


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 79: AS350 SD1 hemispheres for run number 301148, normalized, 69.3 KTAS, -1.0° FPA.

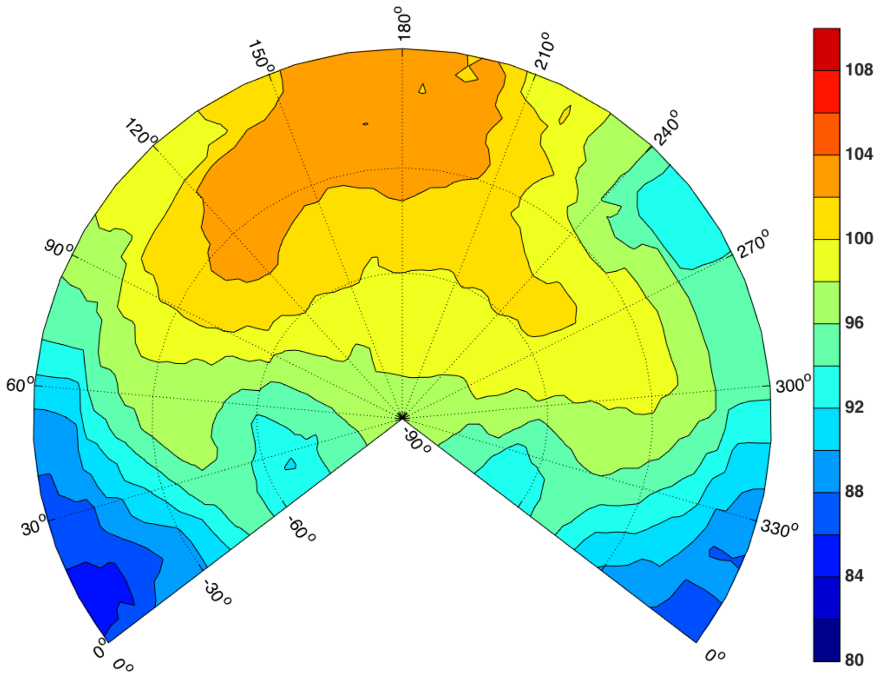


(a) OASPL, 0 to 6000 Hz, decibels.

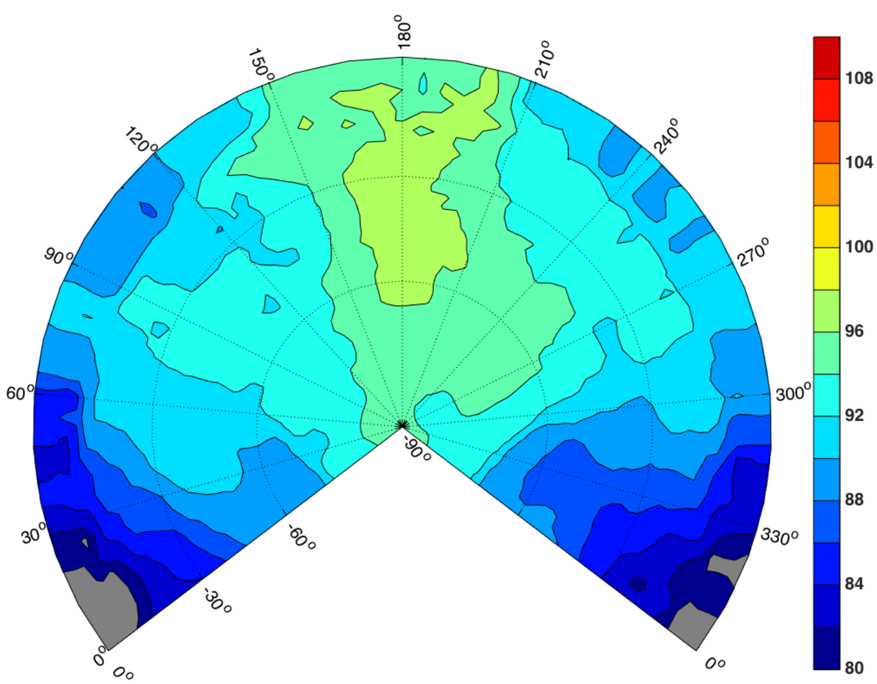


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 80: AS350 SD1 hemispheres for run number 301149, normalized, 80.0 KTAS, -0.5° FPA.

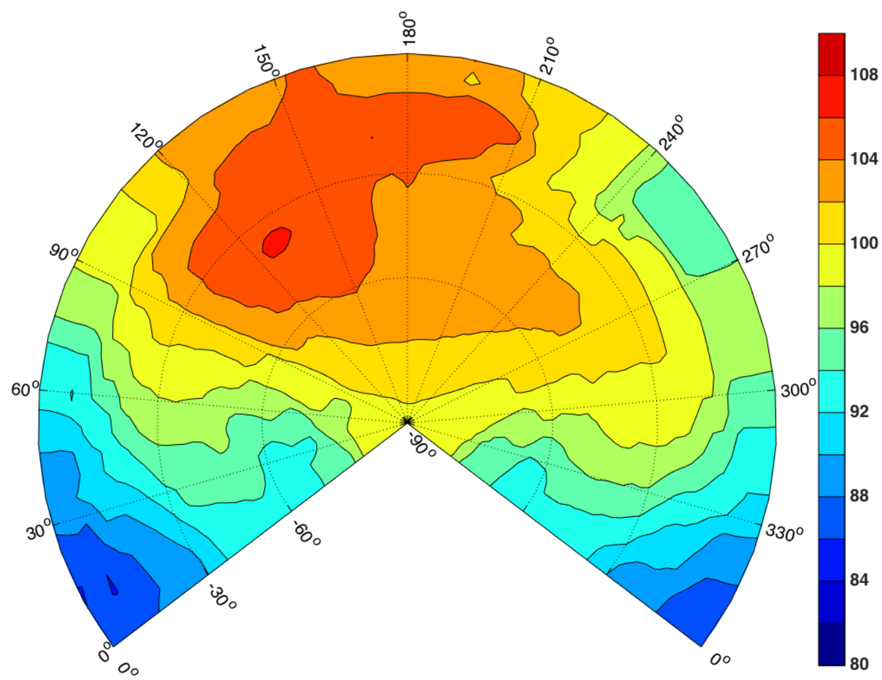


(a) OASPL, 0 to 6000 Hz, decibels.

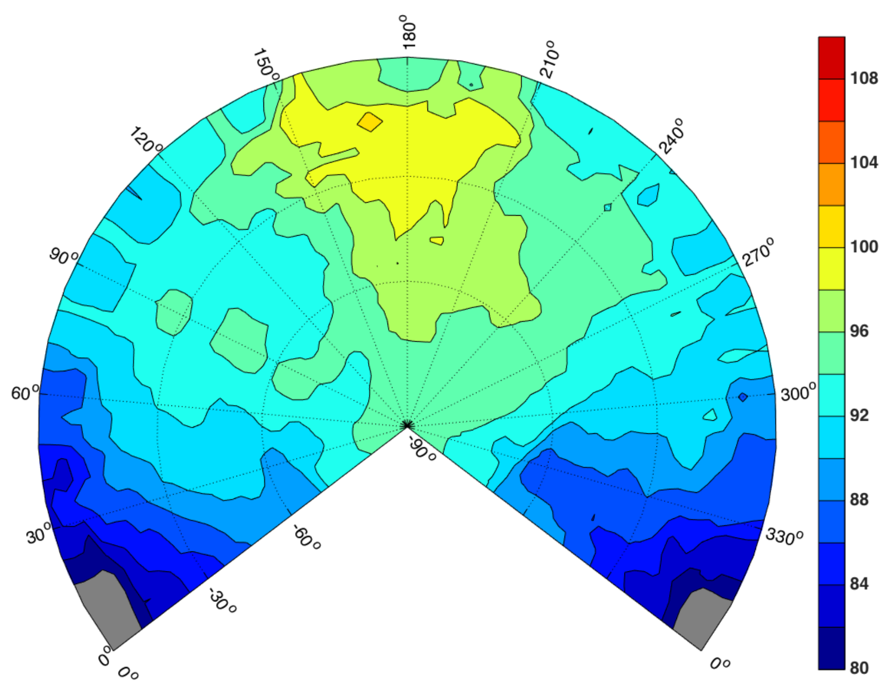


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 81: AS350 SD1 hemispheres for run number 301150, normalized, 101.9 KTAS, -0.3° FPA.

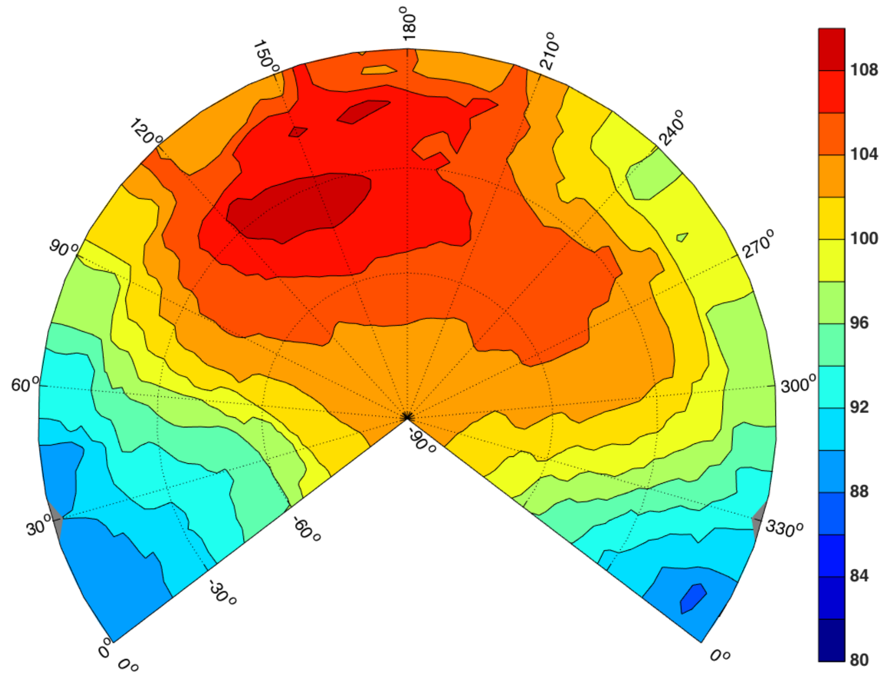


(a) OASPL, 0 to 6000 Hz, decibels.

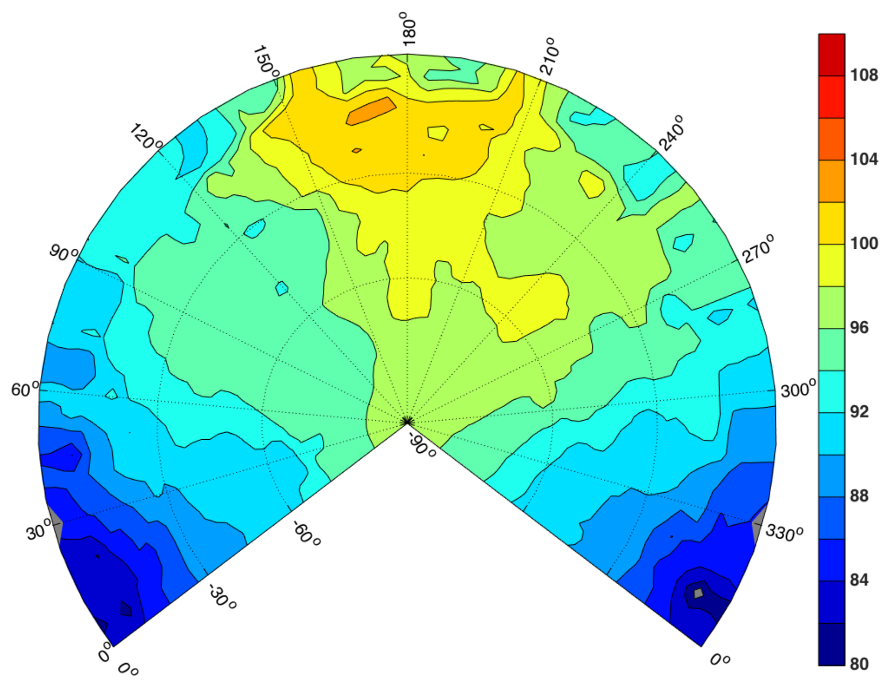


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 82: AS350 SD1 hemispheres for run number 301151, normalized, 111.9 KTAS, -0.3° FPA.

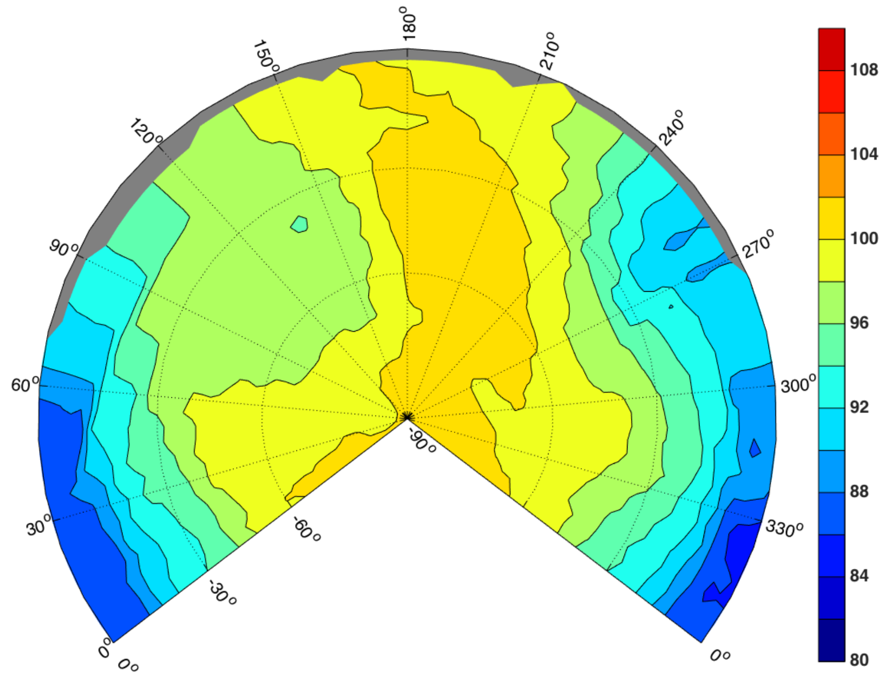


(a) OASPL, 0 to 6000 Hz, decibels.

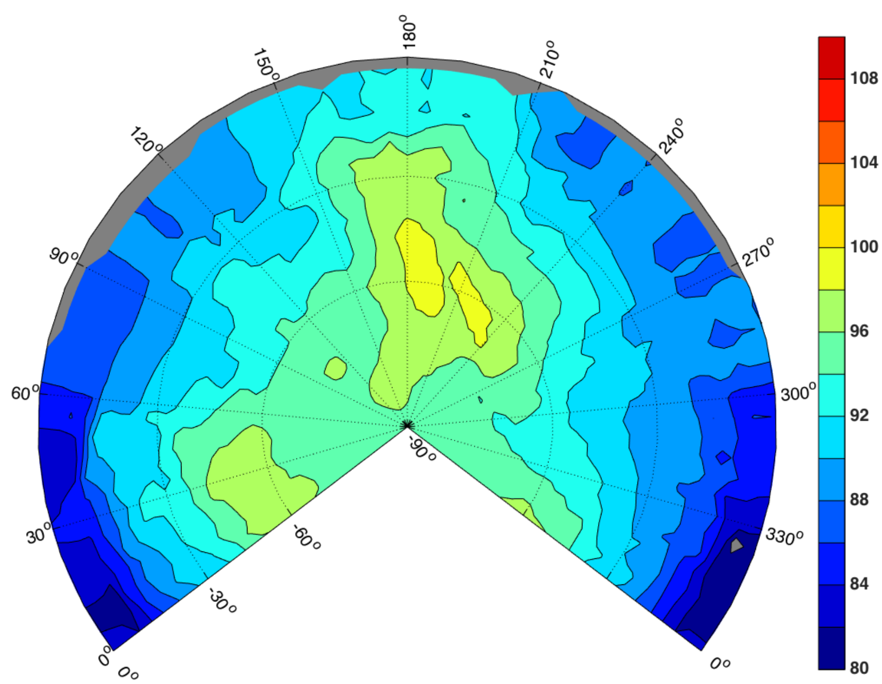


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 83: AS350 SD1 hemispheres for run number 301152, normalized, 122.8 KTAS, 0.3° FPA.

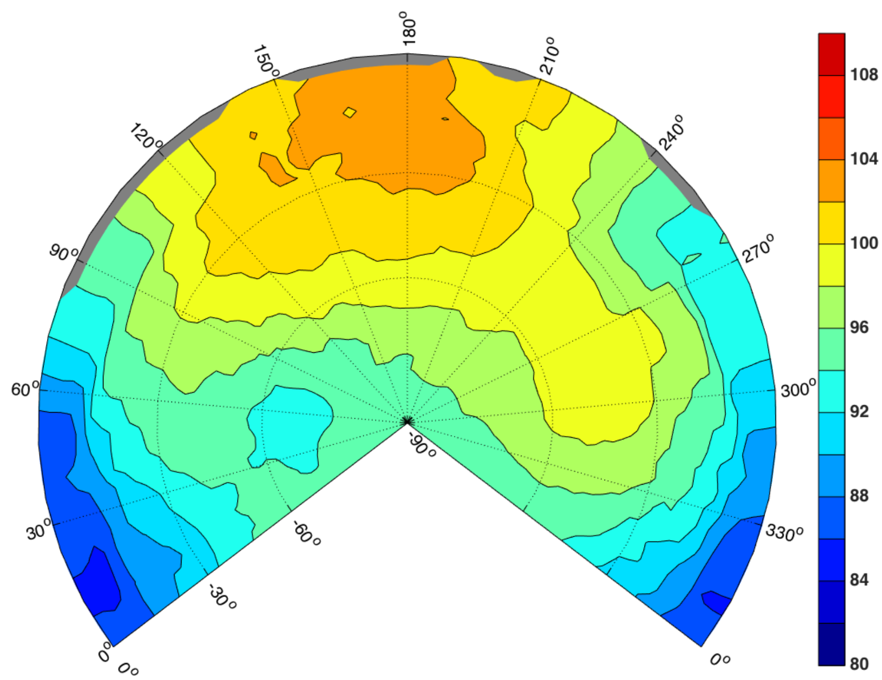


(a) OASPL, 0 to 6000 Hz, decibels.

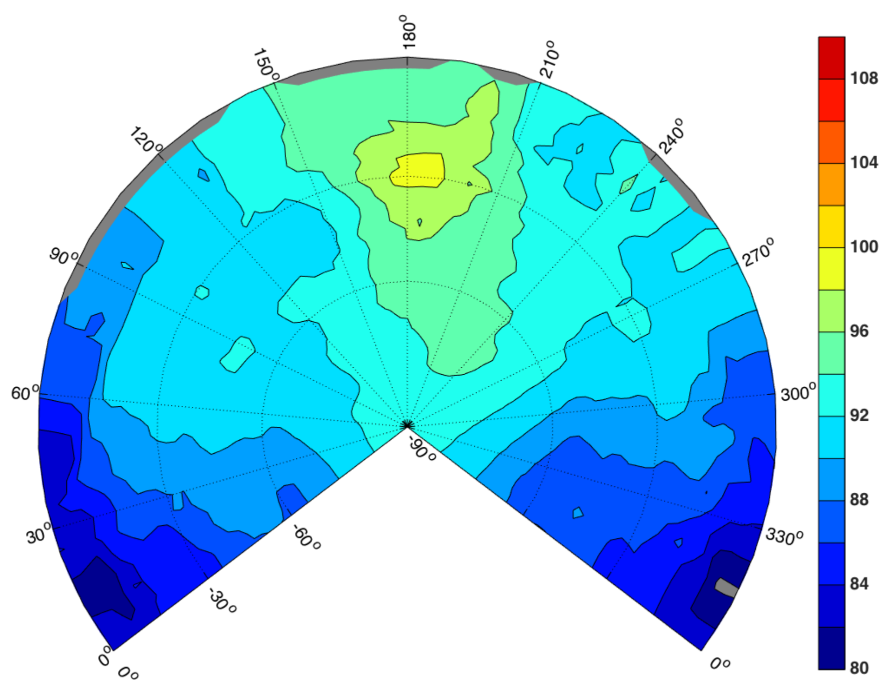


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 84: AS350 SD1 hemispheres for run number 45521, normalized, 89.4 KTAS, -4.7° FPA.

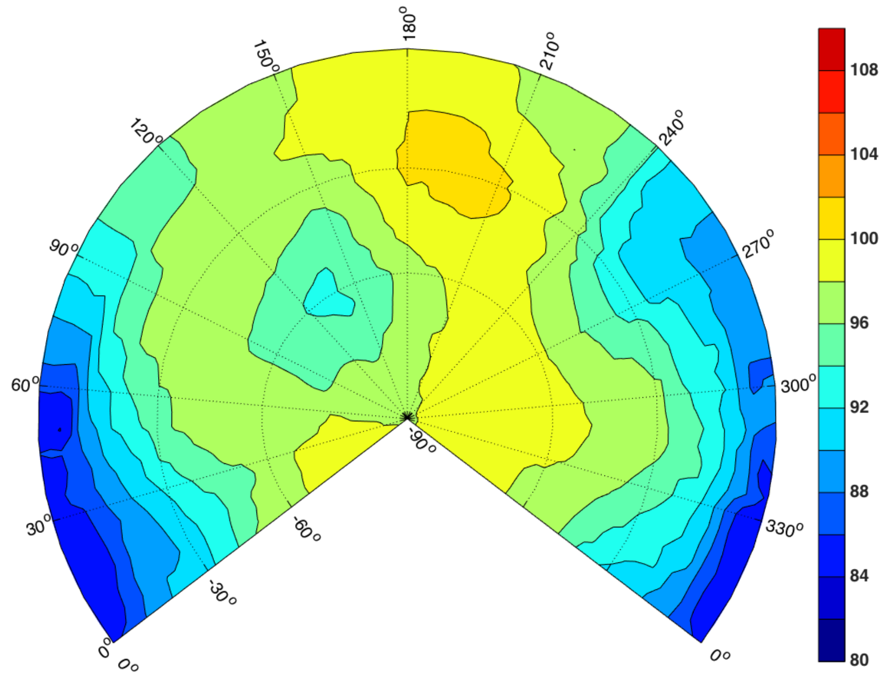


(a) OASPL, 0 to 6000 Hz, decibels.

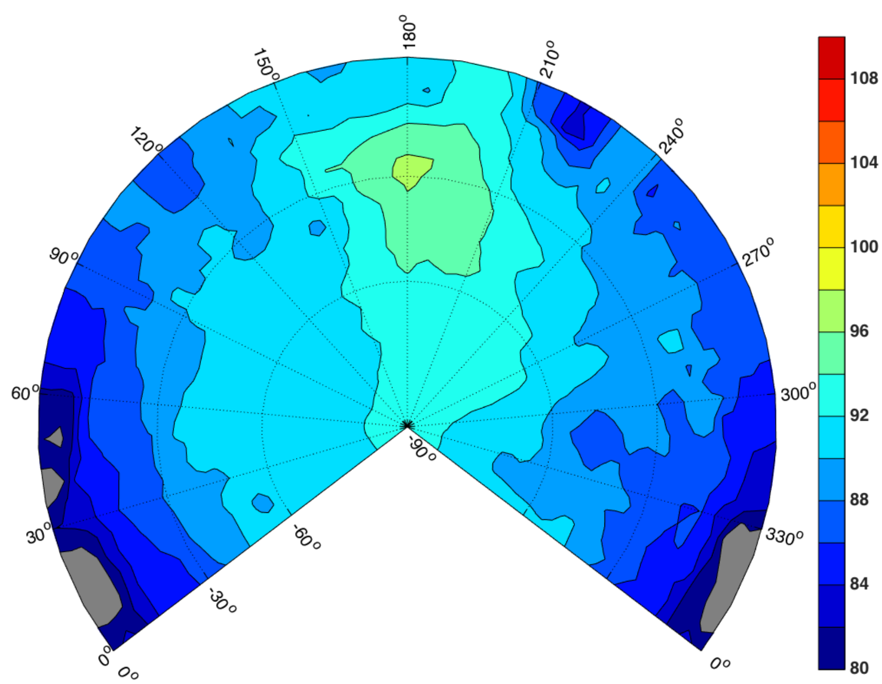


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 85: AS350 SD1 hemispheres for run number 45522, normalized, 108.3 KTAS, -4.3° FPA.

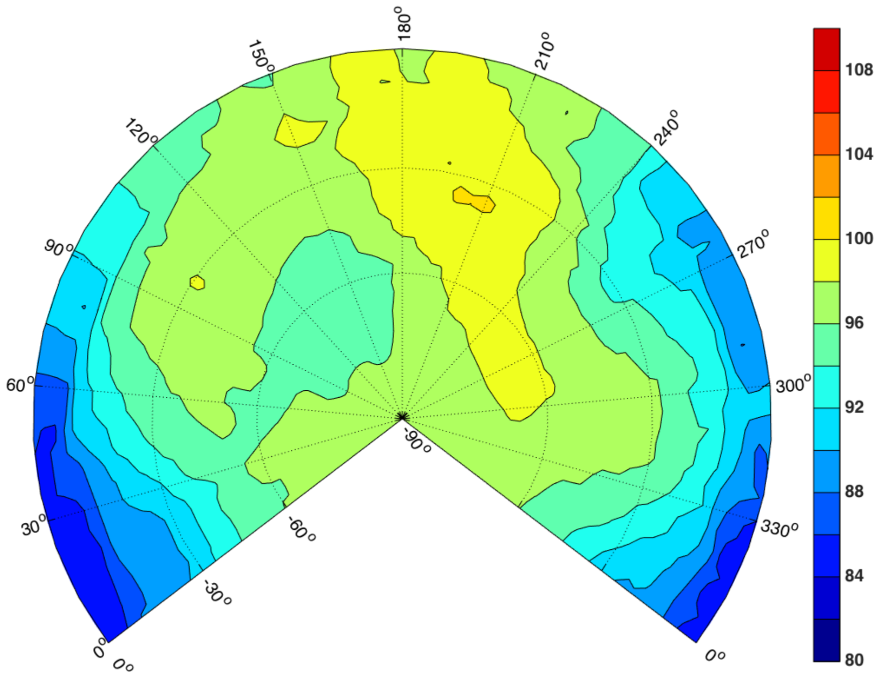


(a) OASPL, 0 to 6000 Hz, decibels.

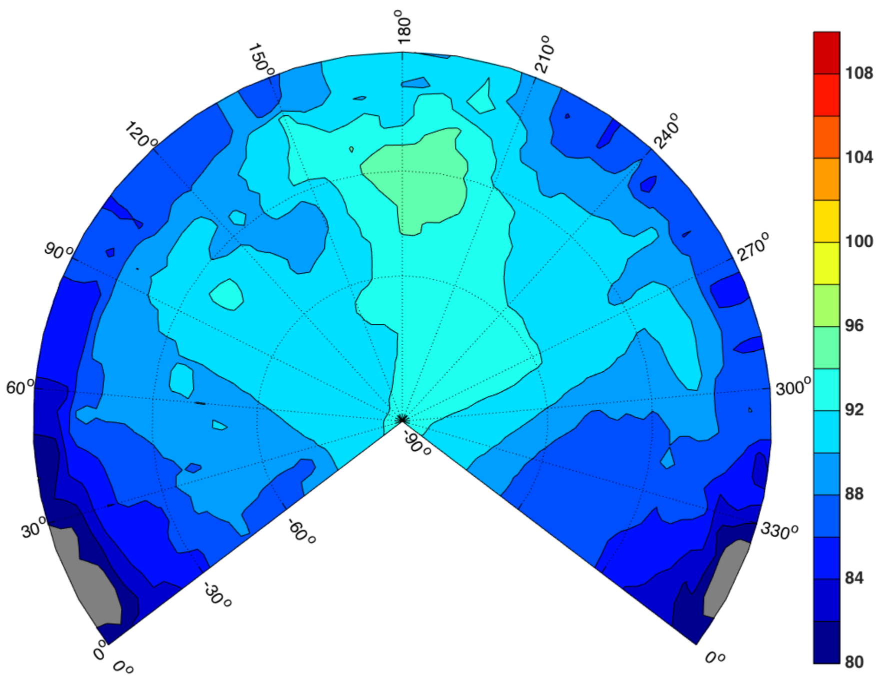


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 86: AS350 SD1 hemispheres for run number 45523, normalized, 86.4 KTAS, -3.1° FPA.

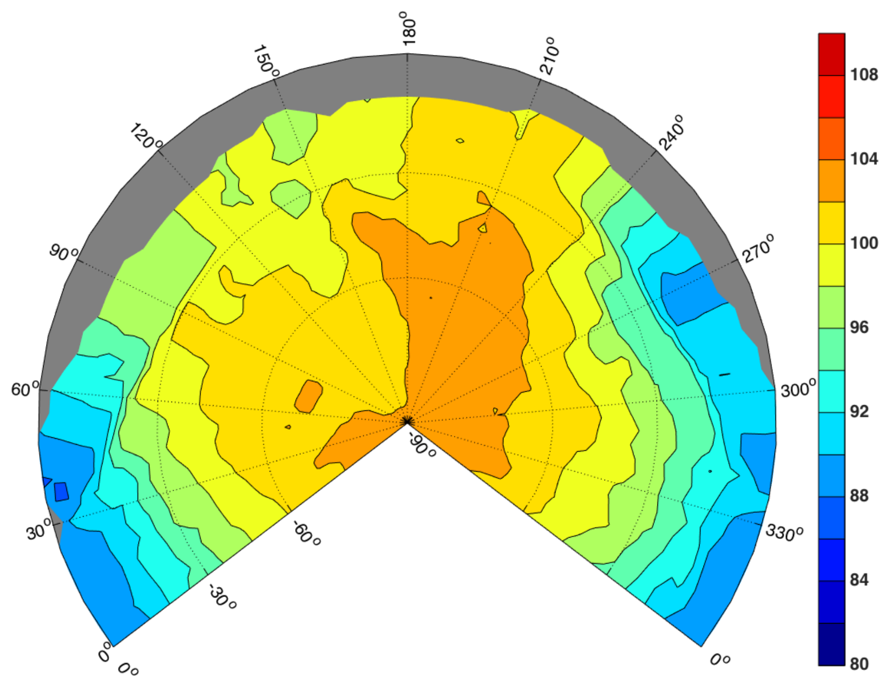


(a) OASPL, 0 to 6000 Hz, decibels.

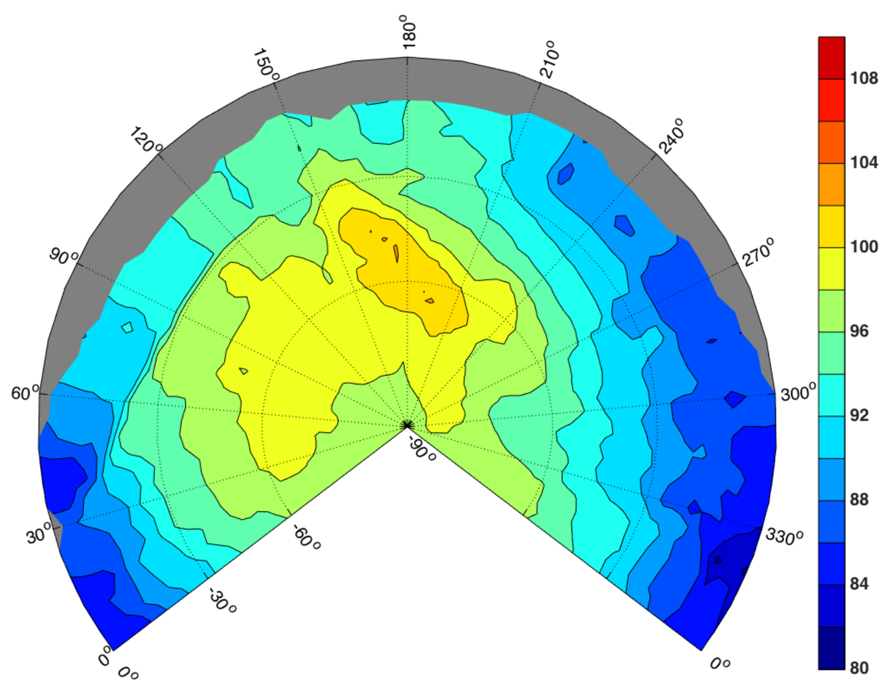


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 87: AS350 SD1 hemispheres for run number 45524, normalized, 86.7 KTAS, -3.0° FPA.

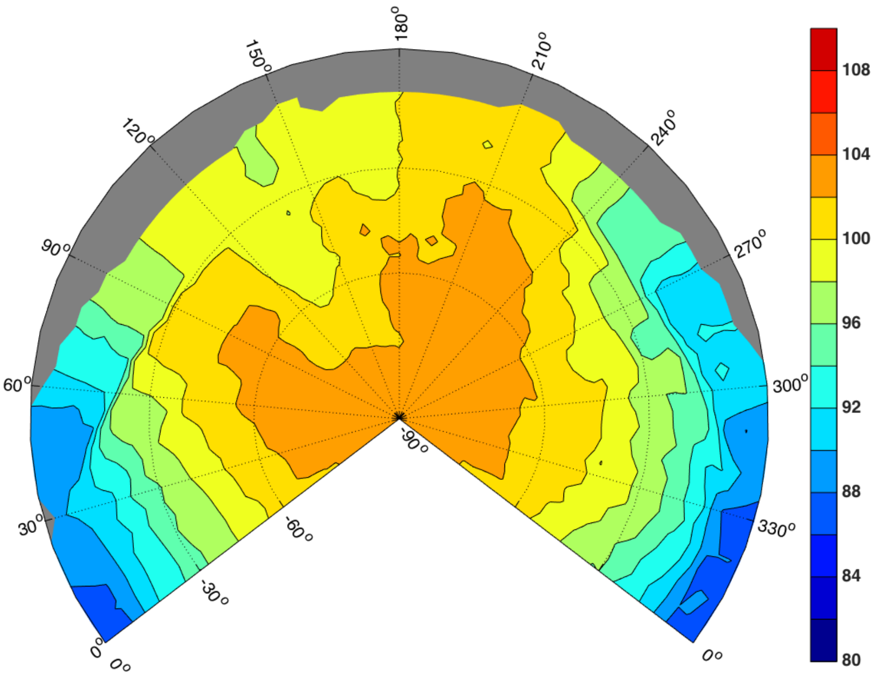


(a) OASPL, 0 to 6000 Hz, decibels.

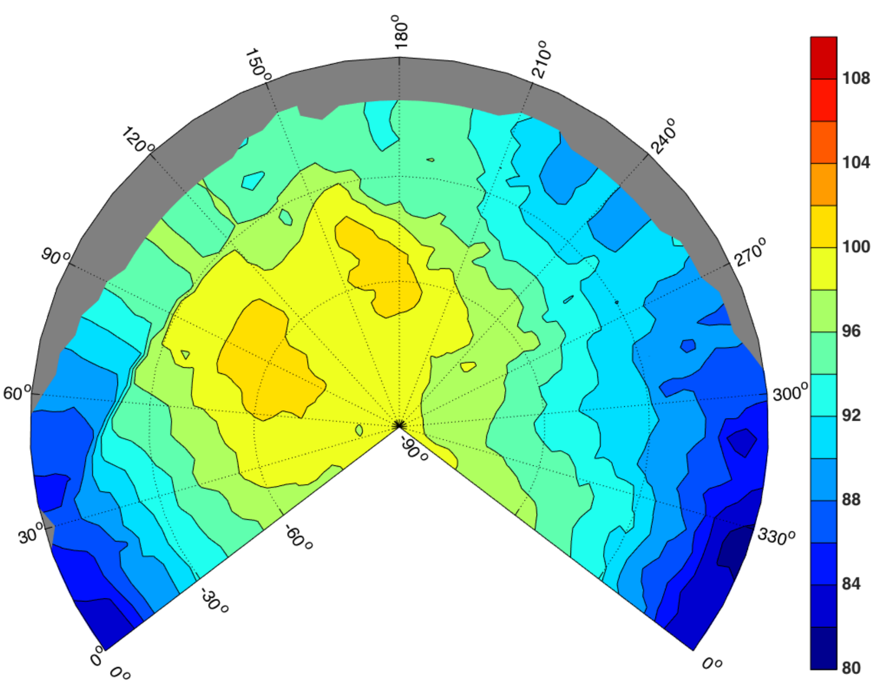


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 88: AS350 SD1 hemispheres for run number 45525, normalized, 89.4 KTAS, -8.6° FPA.

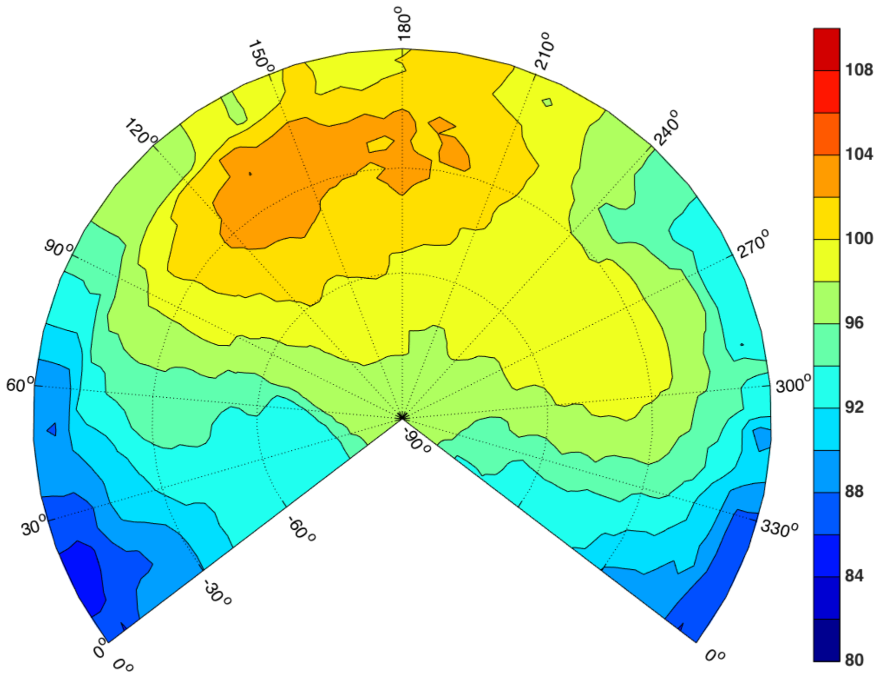


(a) OASPL, 0 to 6000 Hz, decibels.

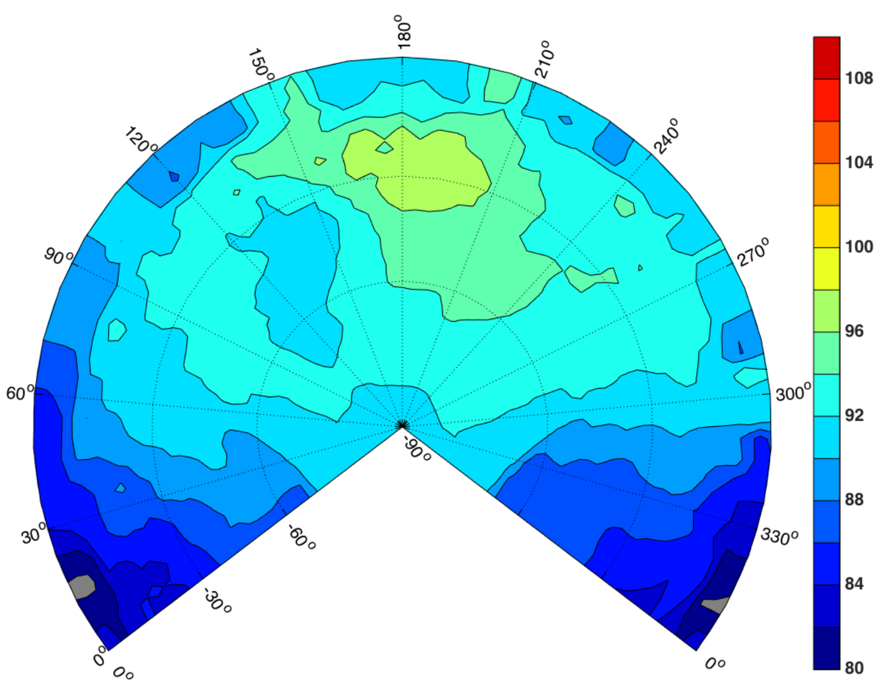


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 89: AS350 SD1 hemispheres for run number 45526, normalized, 90.7 KTAS, -9.2° FPA.

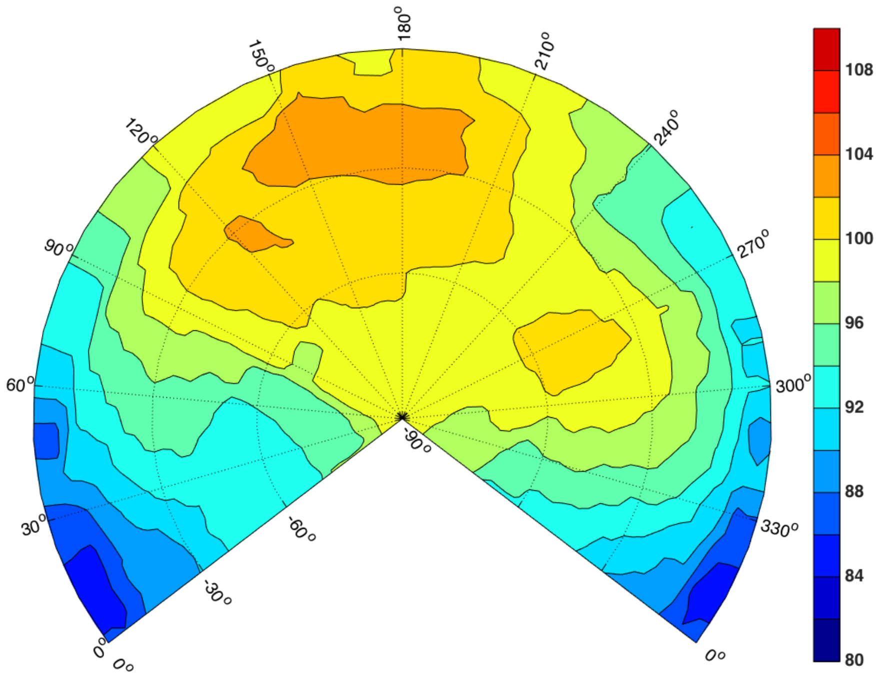


(a) OASPL, 0 to 6000 Hz, decibels.

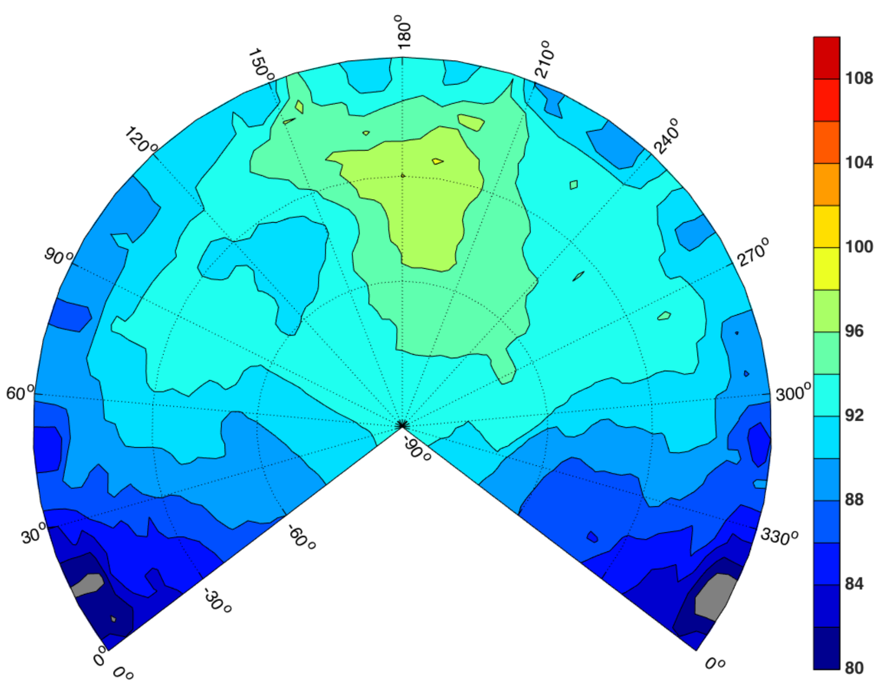


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 90: AS350 SD1 hemispheres for run number 45527, normalized, 106.2 KTAS, -2.4° FPA.

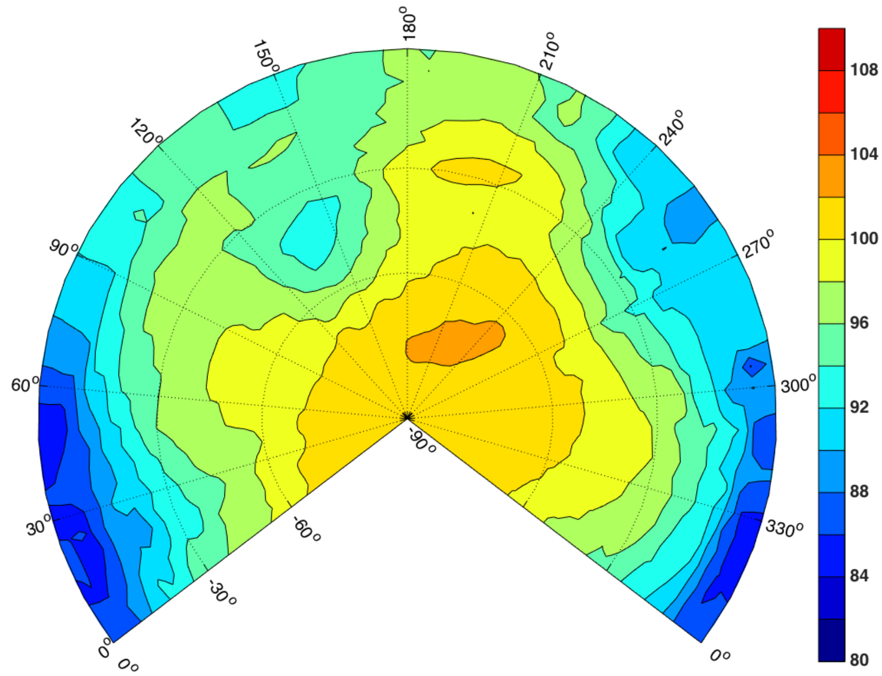


(a) OASPL, 0 to 6000 Hz, decibels.

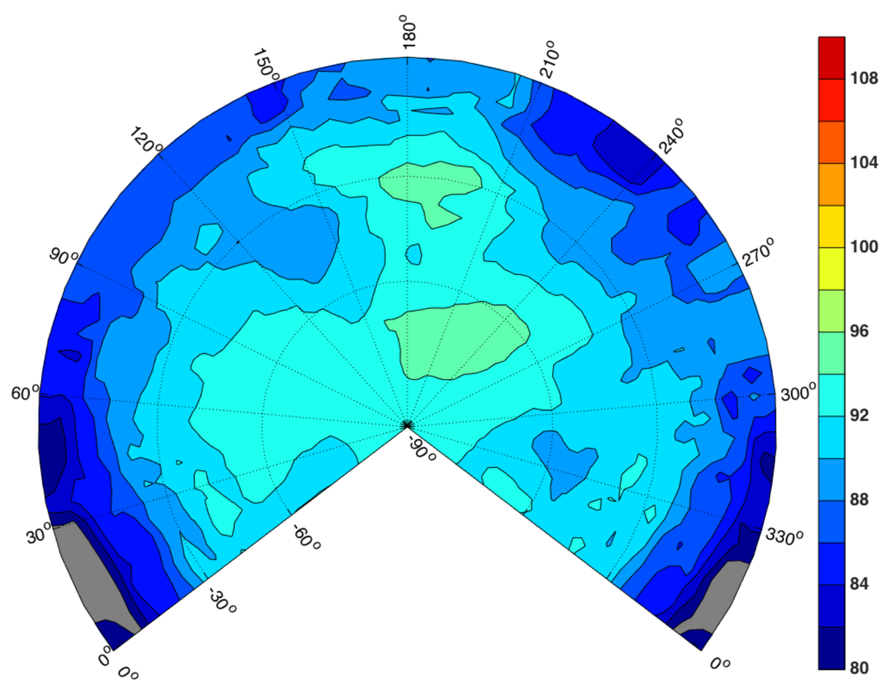


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 91: AS350 SD1 hemispheres for run number 45528, normalized, 107.1 KTAS, -2.3° FPA.

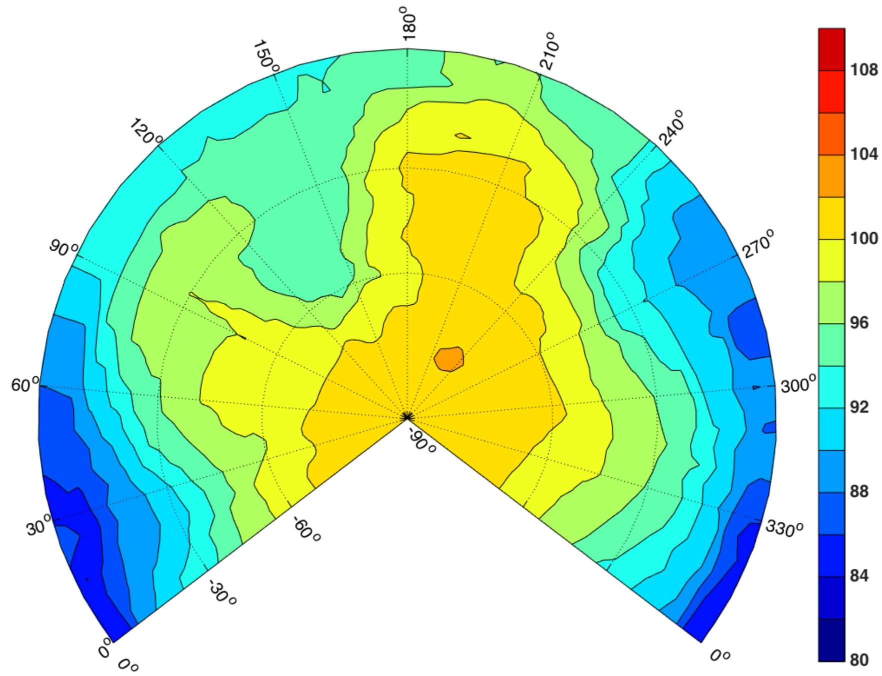


(a) OASPL, 0 to 6000 Hz, decibels.

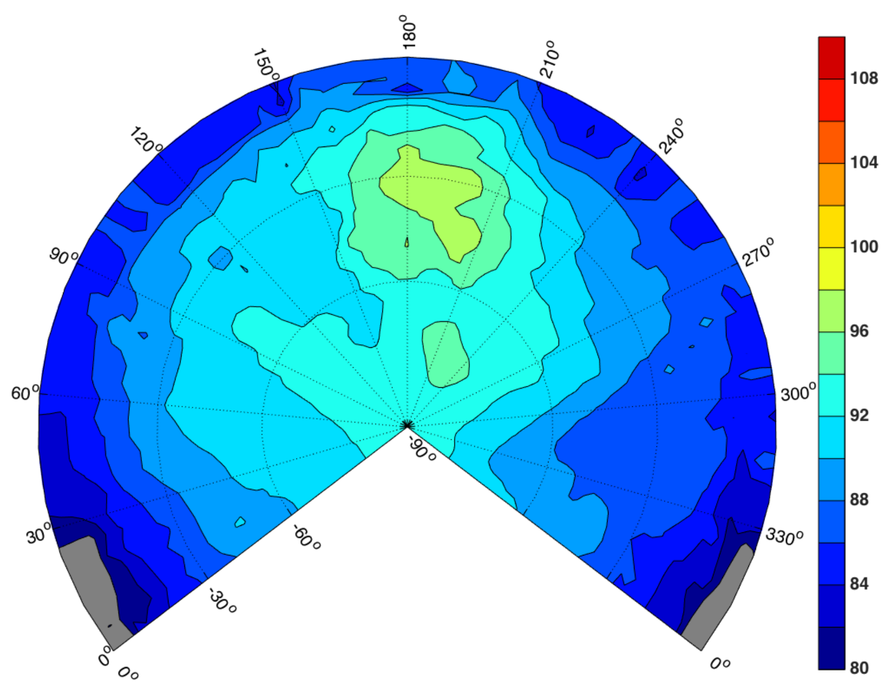


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 92: AS350 SD1 hemispheres for run number 45529, normalized, 66.8 KTAS, -2.6° FPA.

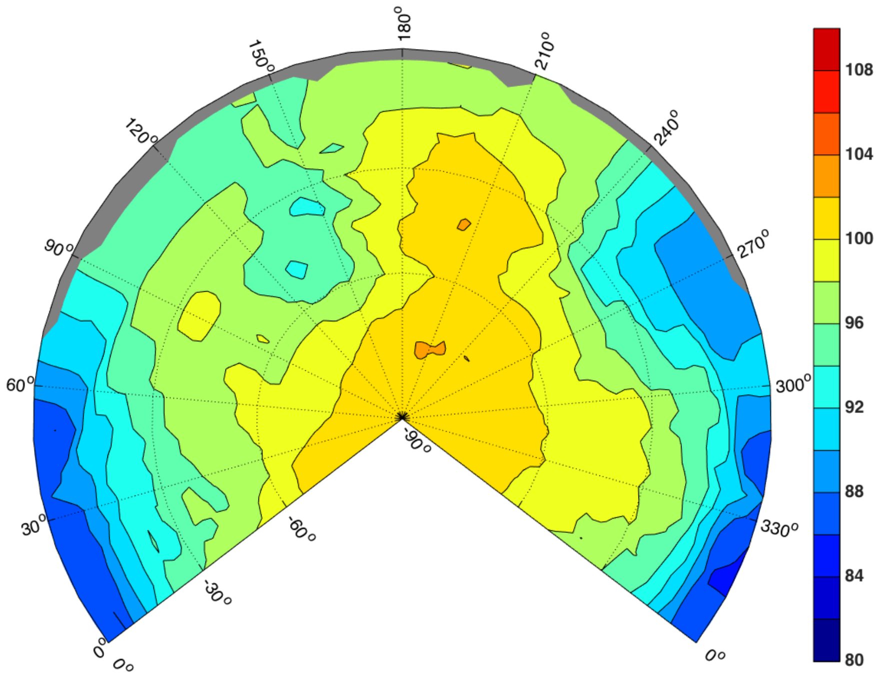


(a) OASPL, 0 to 6000 Hz, decibels.

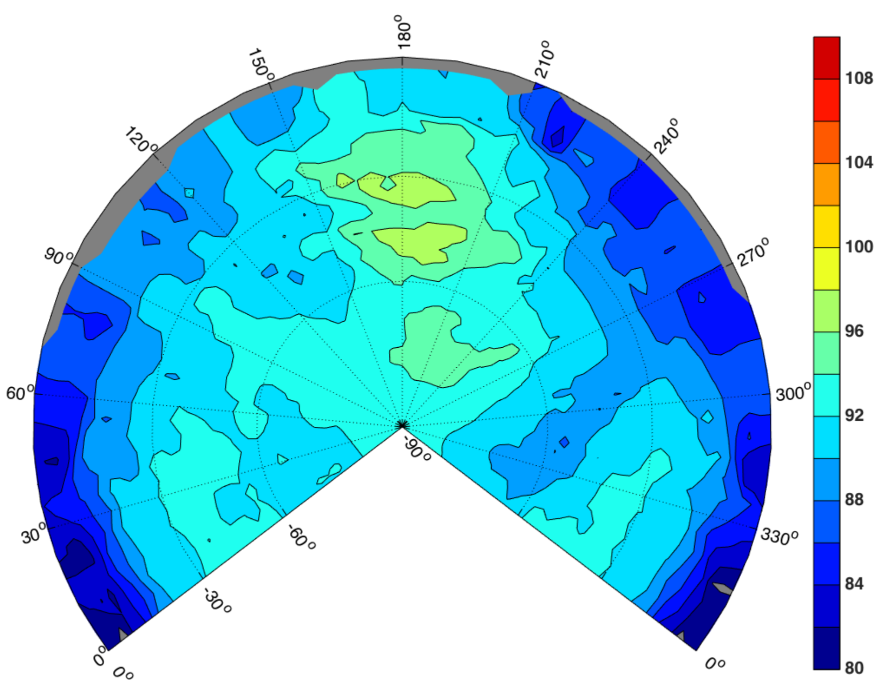


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 93: AS350 SD1 hemispheres for run number 45530, normalized, 66.7 KTAS, -2.8° FPA.

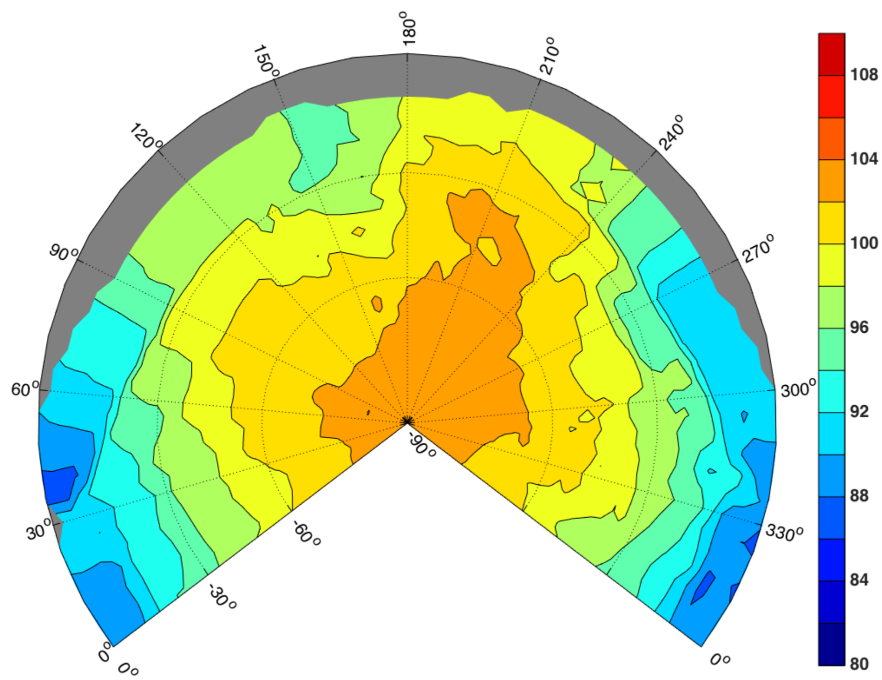


(a) OASPL, 0 to 6000 Hz, decibels.

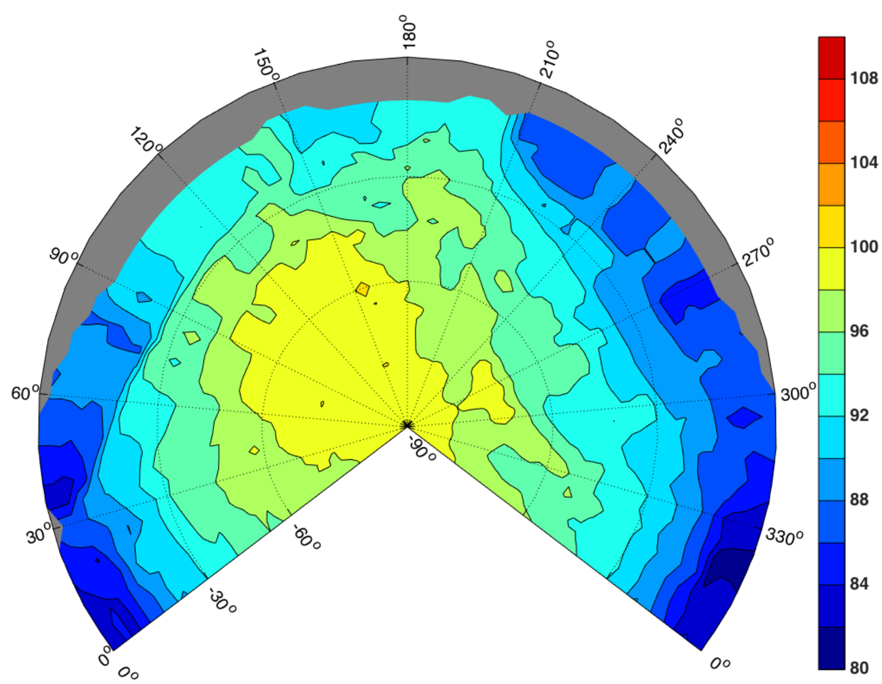


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 94: AS350 SD1 hemispheres for run number 45531, normalized, 67.0 KTAS, -5.1° FPA.

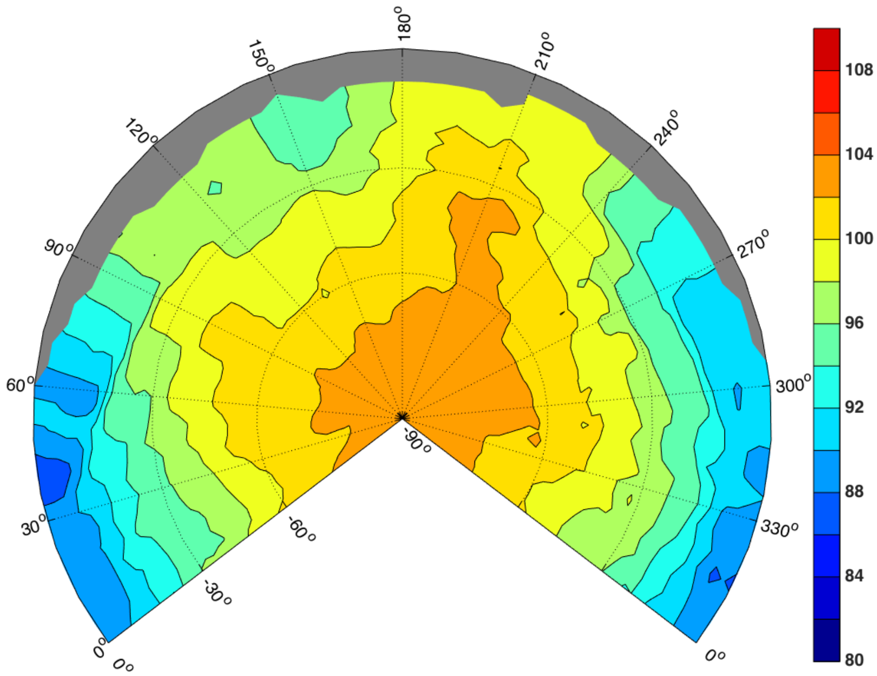


(a) OASPL, 0 to 6000 Hz, decibels.

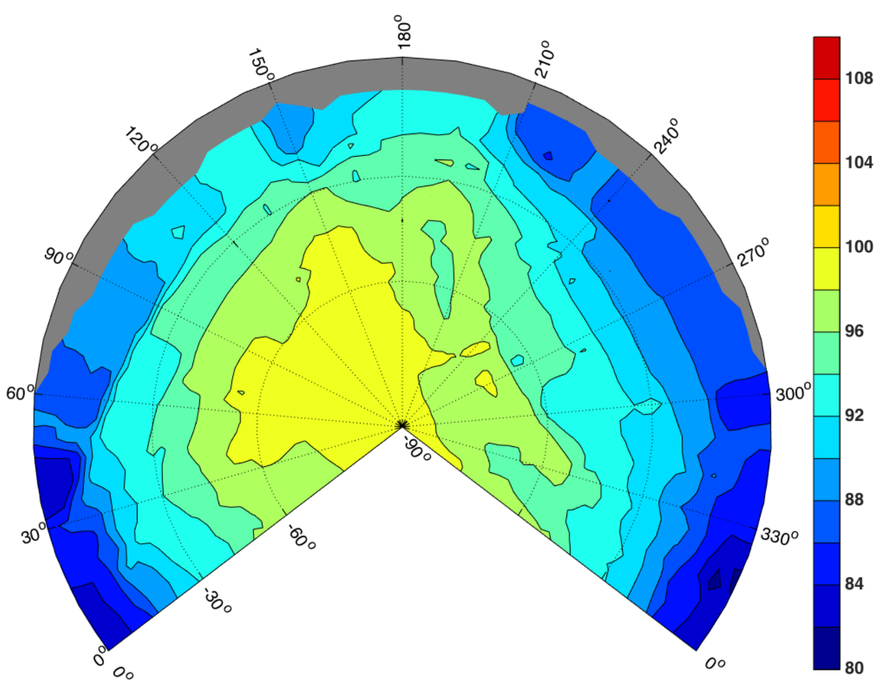


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 95: AS350 SD1 hemispheres for run number 45533, normalized, 67.8 KTAS, -8.5° FPA.

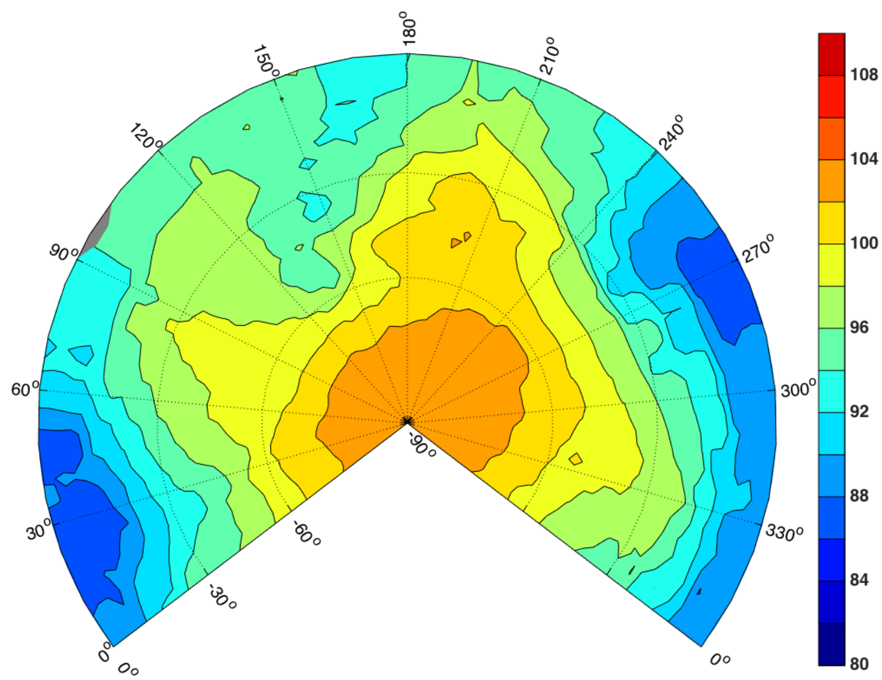


(a) OASPL, 0 to 6000 Hz, decibels.

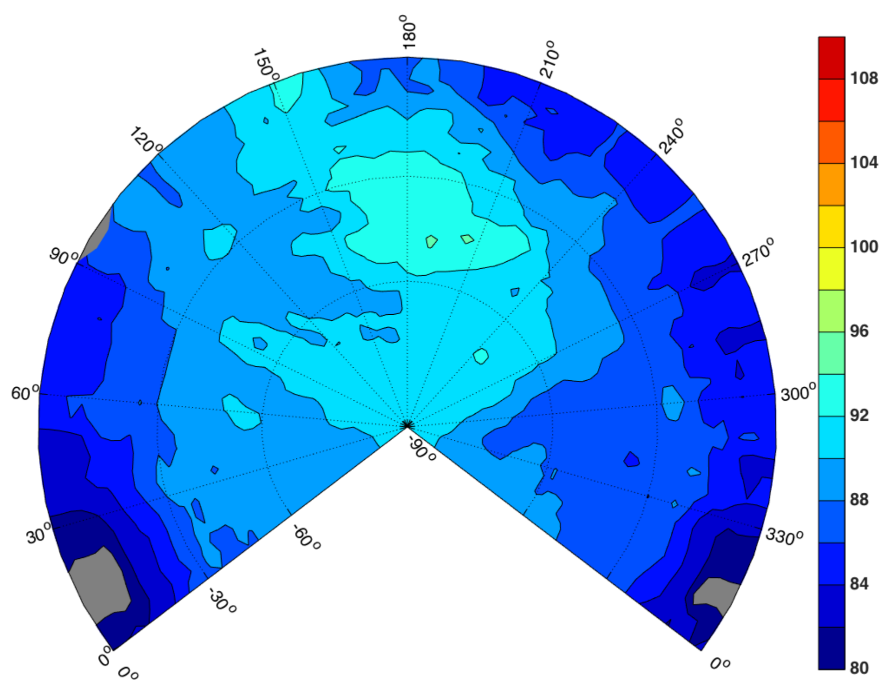


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 96: AS350 SD1 hemispheres for run number 45534, normalized, 67.7 KTAS, -7.9° FPA.

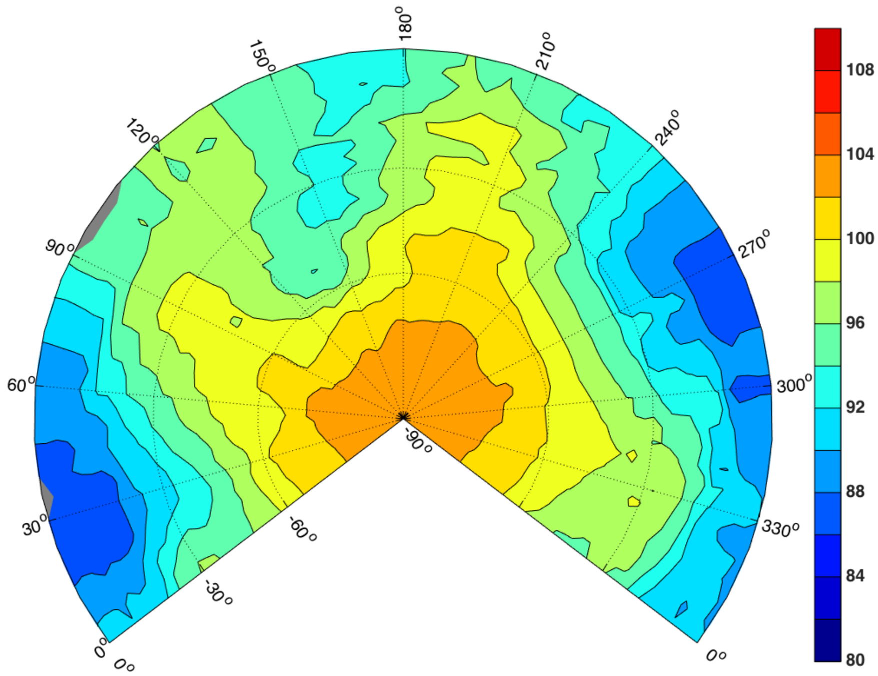


(a) OASPL, 0 to 6000 Hz, decibels.

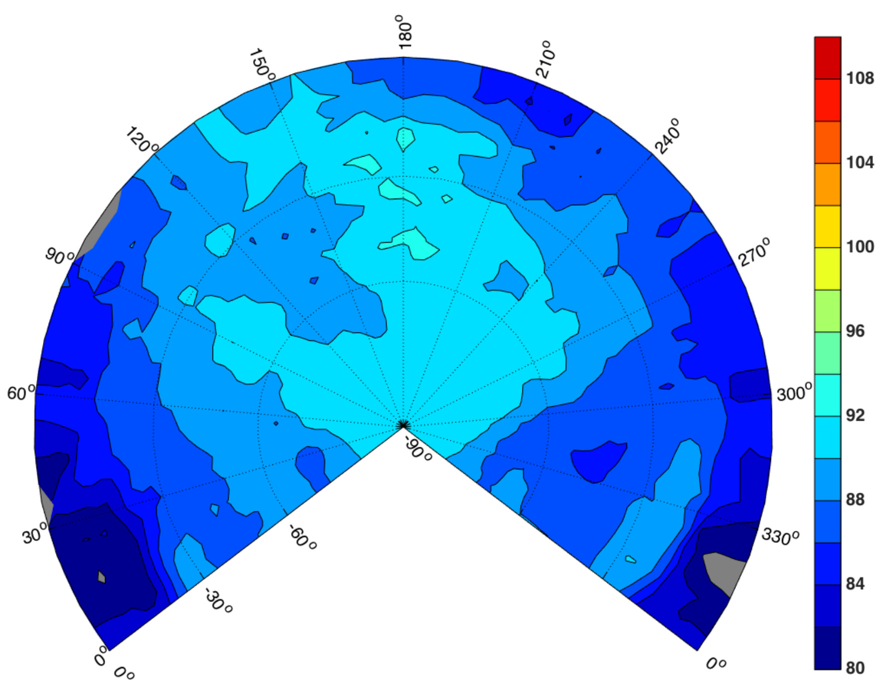


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 97: AS350 SD1 hemispheres for run number 45566, normalized, 47.8 KTAS, -0.2° FPA.

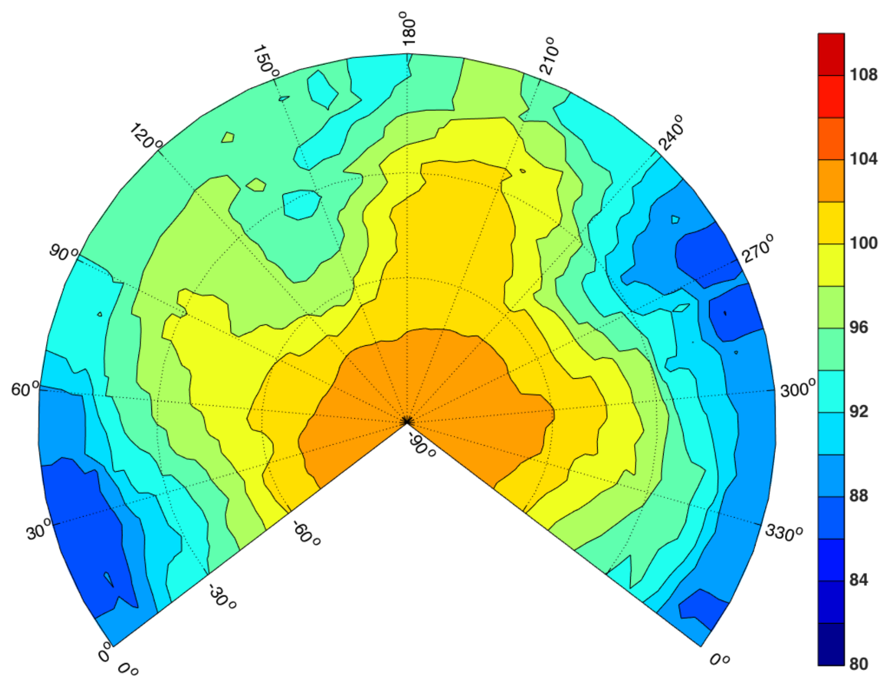


(a) OASPL, 0 to 6000 Hz, decibels.

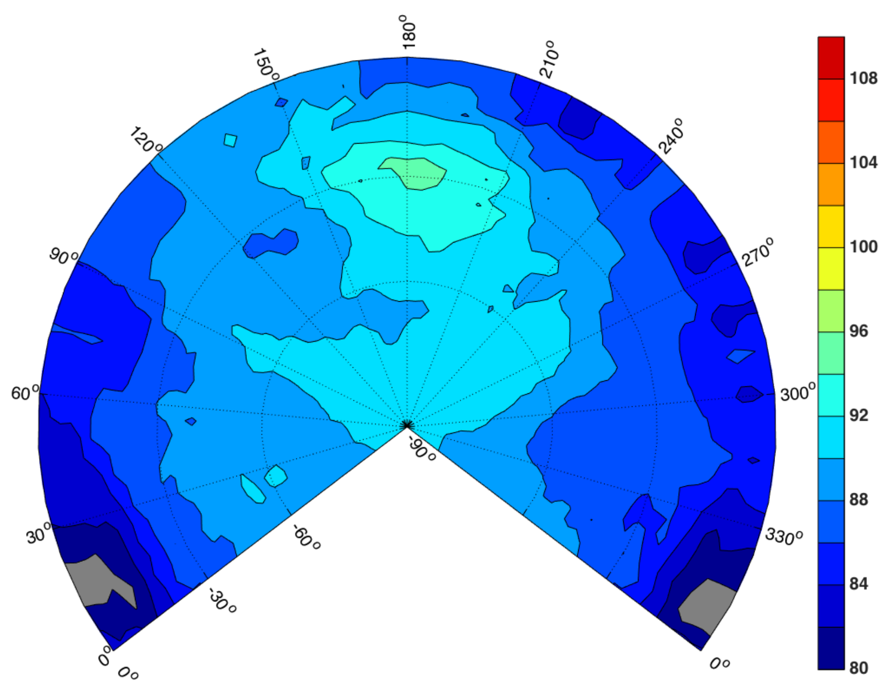


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 98: AS350 SD1 hemispheres for run number 45567, normalized, 48.5 KTAS, -0.4° FPA.

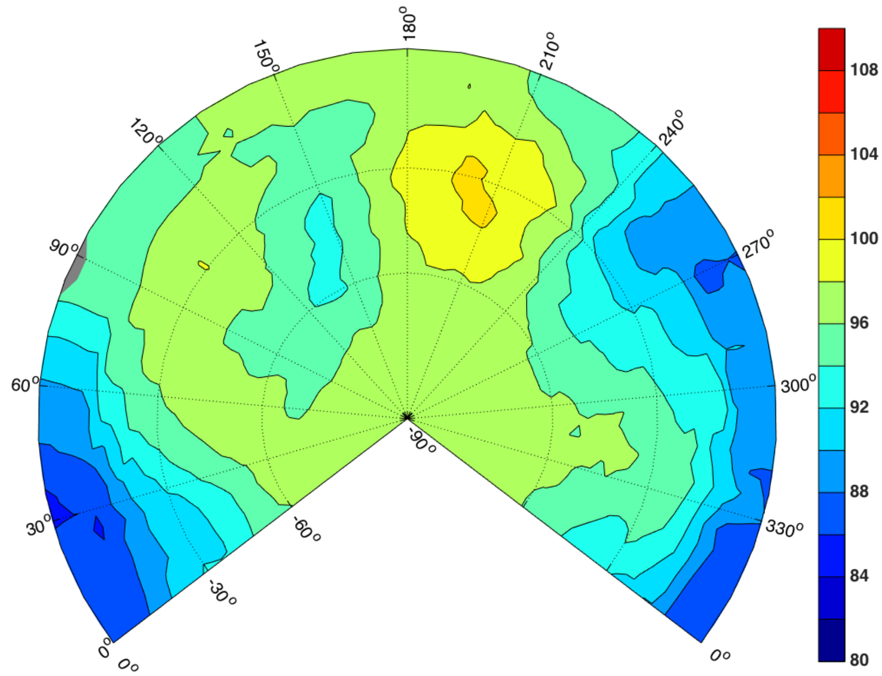


(a) OASPL, 0 to 6000 Hz, decibels.

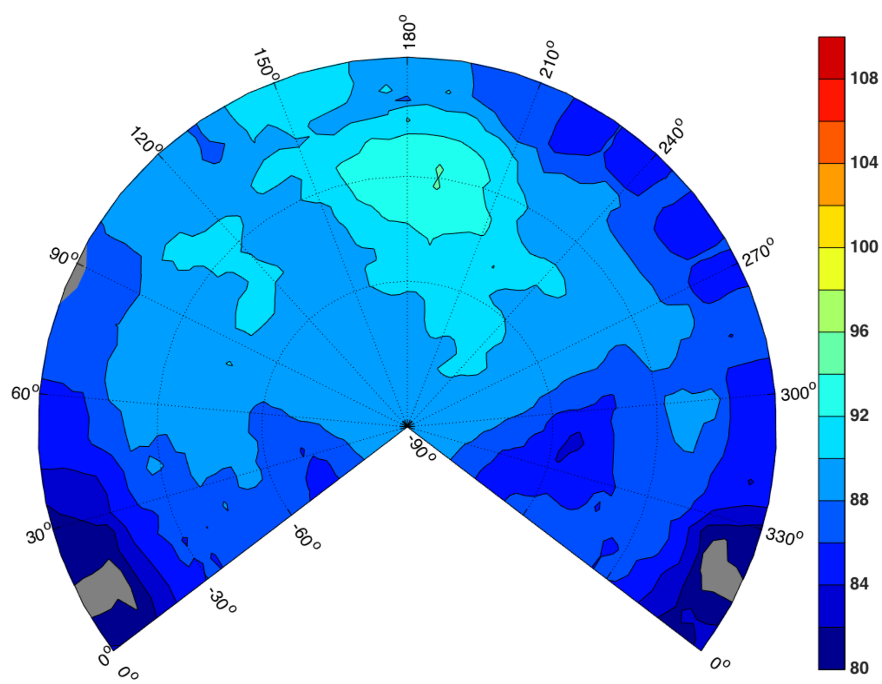


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 99: AS350 SD1 hemispheres for run number 45568, normalized, 47.8 KTAS, -0.2° FPA.

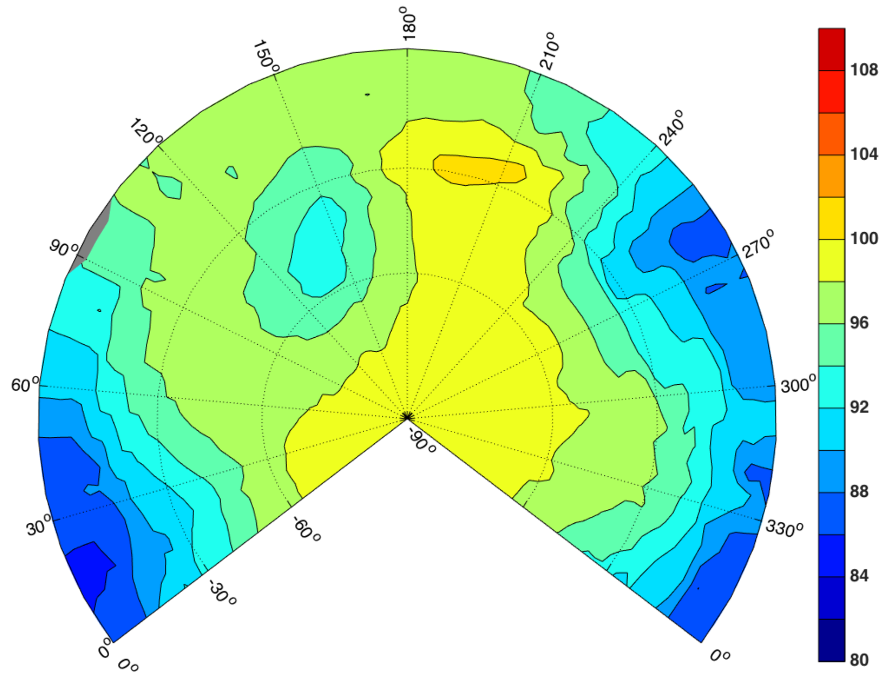


(a) OASPL, 0 to 6000 Hz, decibels.

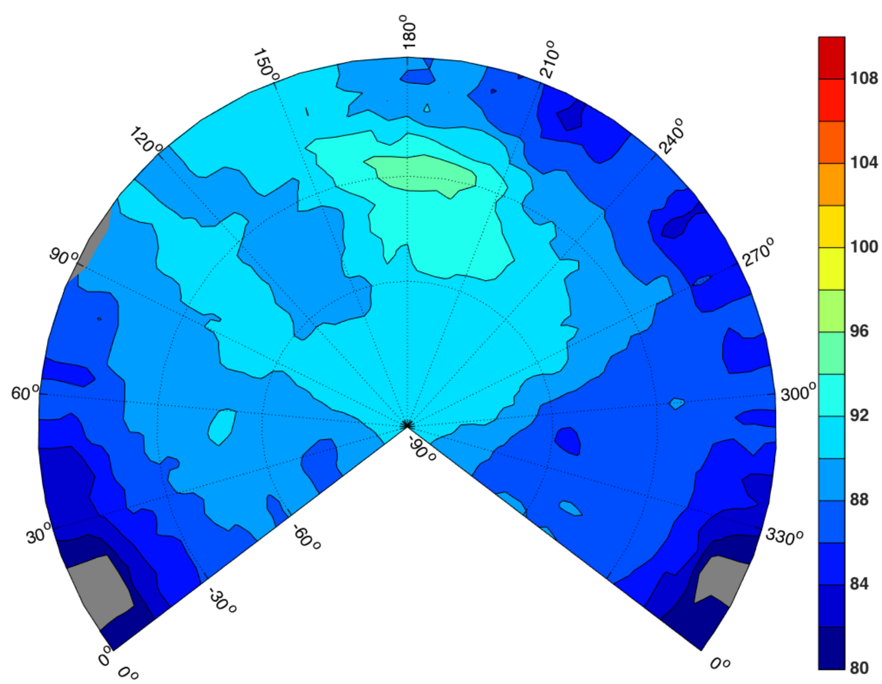


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 100: AS350 SD1 hemispheres for run number 45569, normalized, 66.7 KTAS, -0.3° FPA.

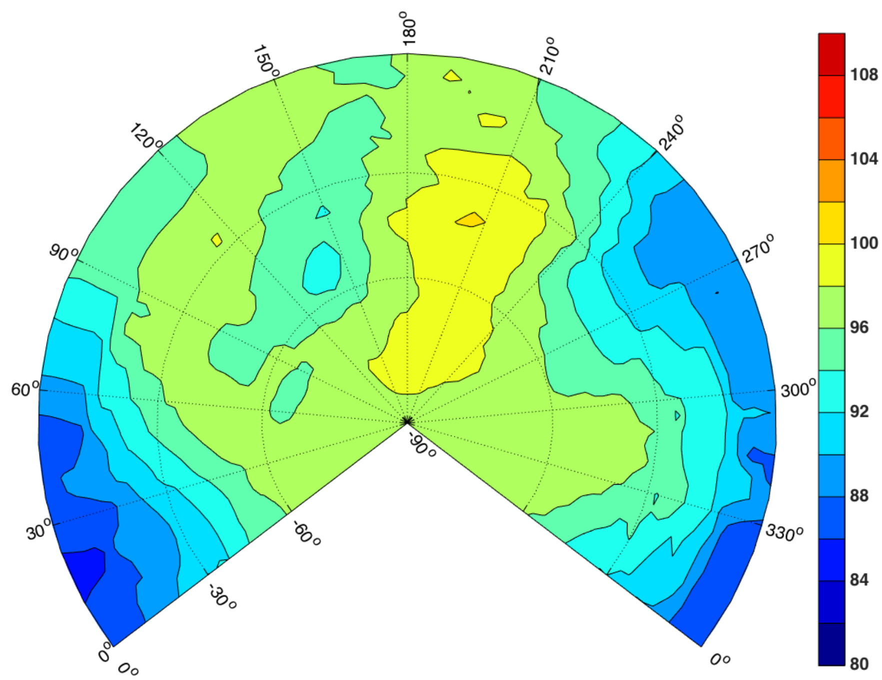


(a) OASPL, 0 to 6000 Hz, decibels.

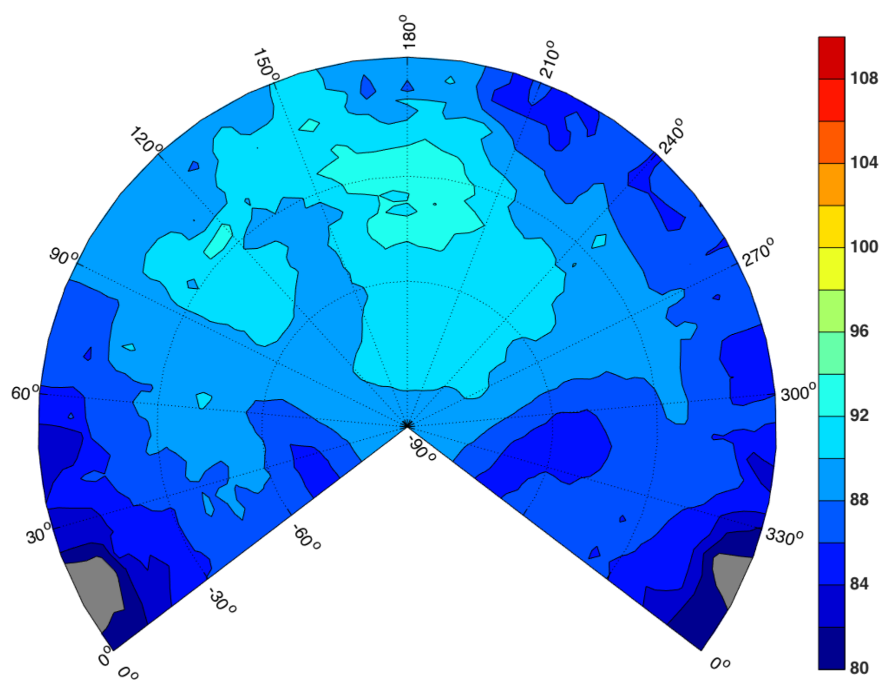


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 101: AS350 SD1 hemispheres for run number 45570, normalized, 67.1 KTAS, -0.2° FPA.

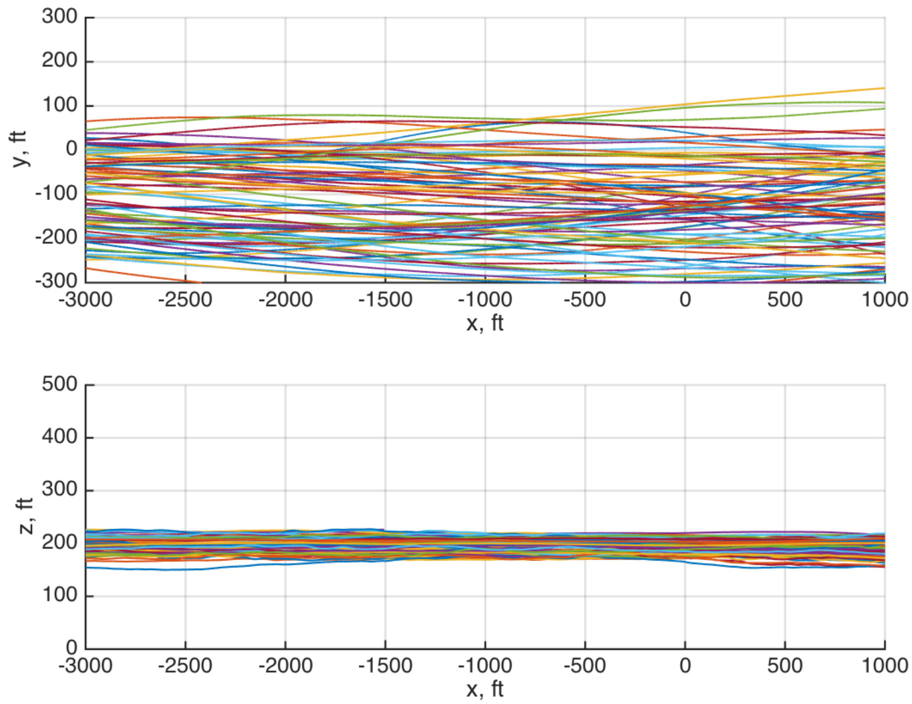


(a) OASPL, 0 to 6000 Hz, decibels.

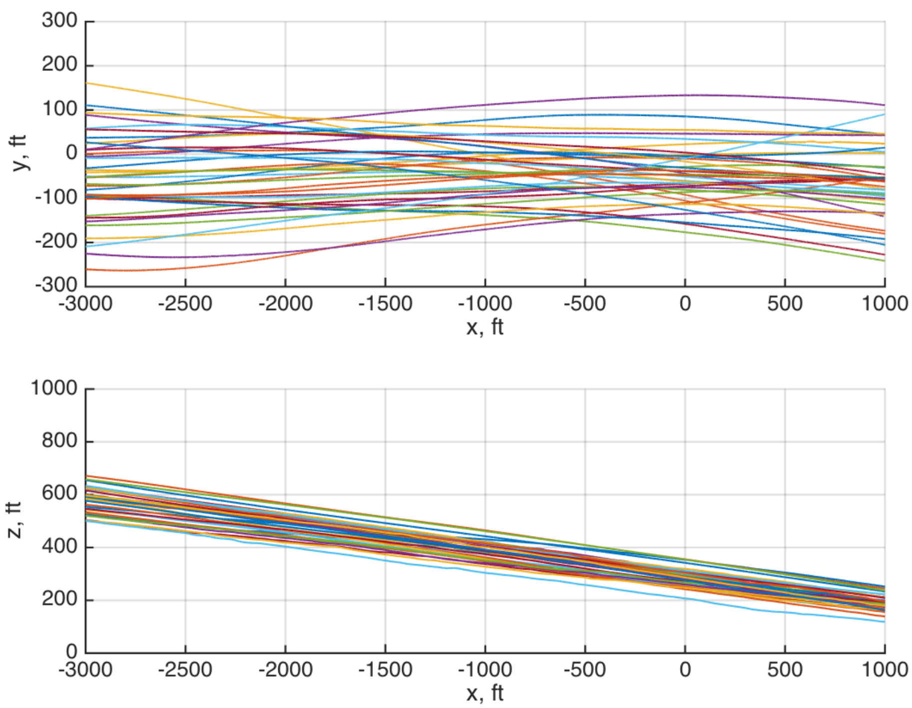


(b) BVISPL, 98.5 to 985 Hz, decibels.

Figure 102: AS350 SD1 hemispheres for run number 45571, normalized, 66.8 KTAS, -0.4° FPA.

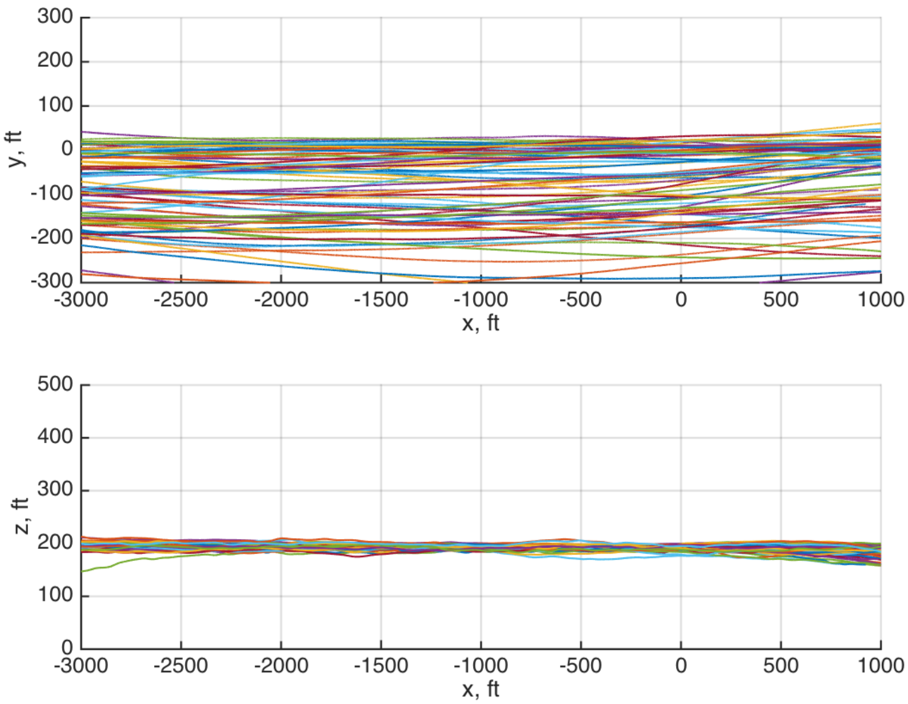


(a) Level flight conditions

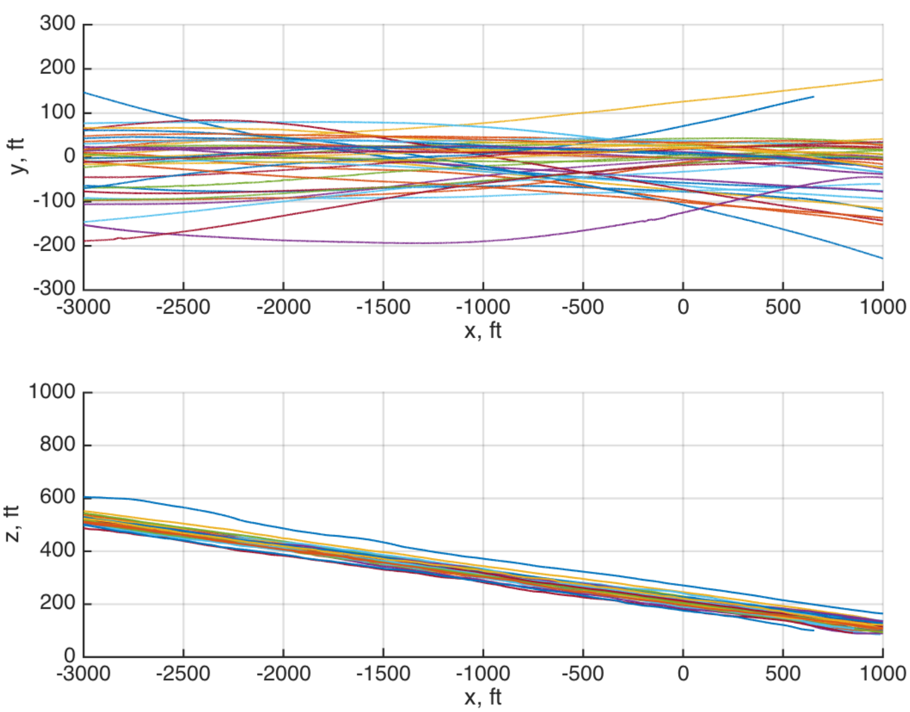


(b) Descending flight conditions

Figure 103: EH-60L flight track repeatability for Sweetwater test phase.

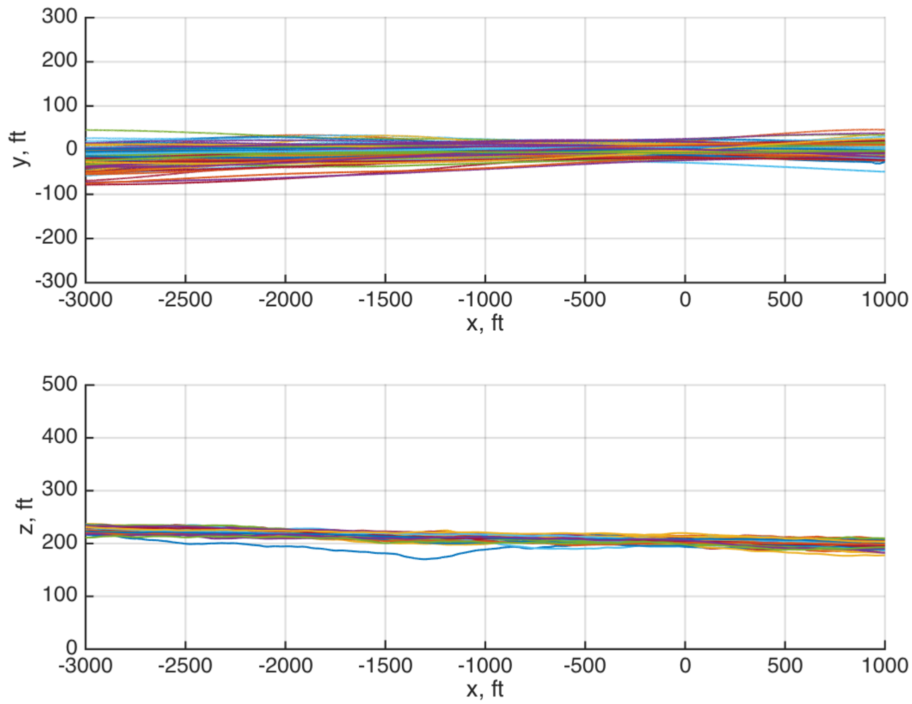


(a) Level flight conditions

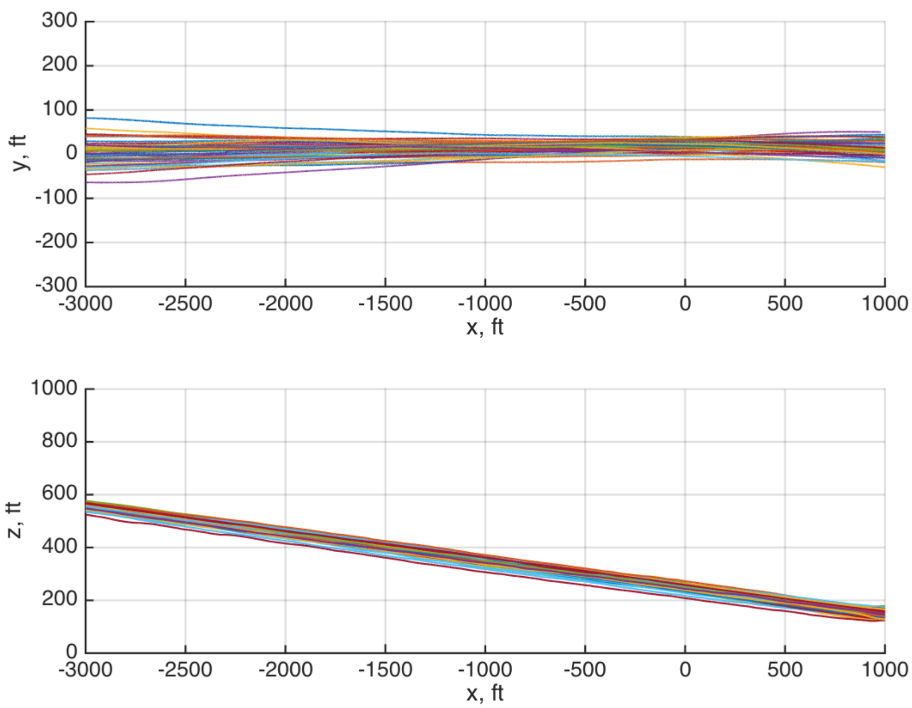


(b) Descending flight conditions

Figure 104: EH-60L flight track repeatability for Amedee test phase.



(a) Level flight conditions



(b) Descending flight conditions

Figure 105: EH-60L flight track repeatability for Salton Sea test phase.

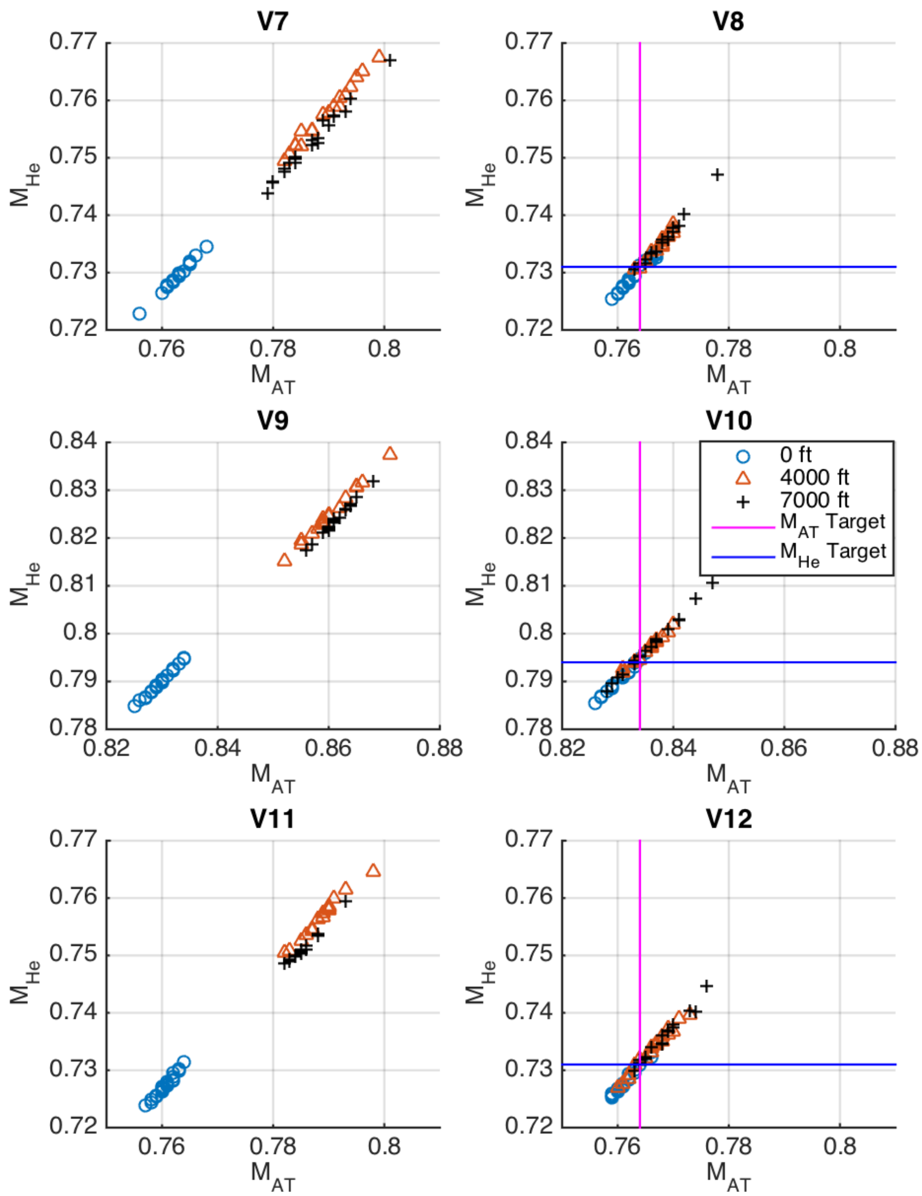


Figure 106: M_{H_e} vs M_{AT} for EH-60L.

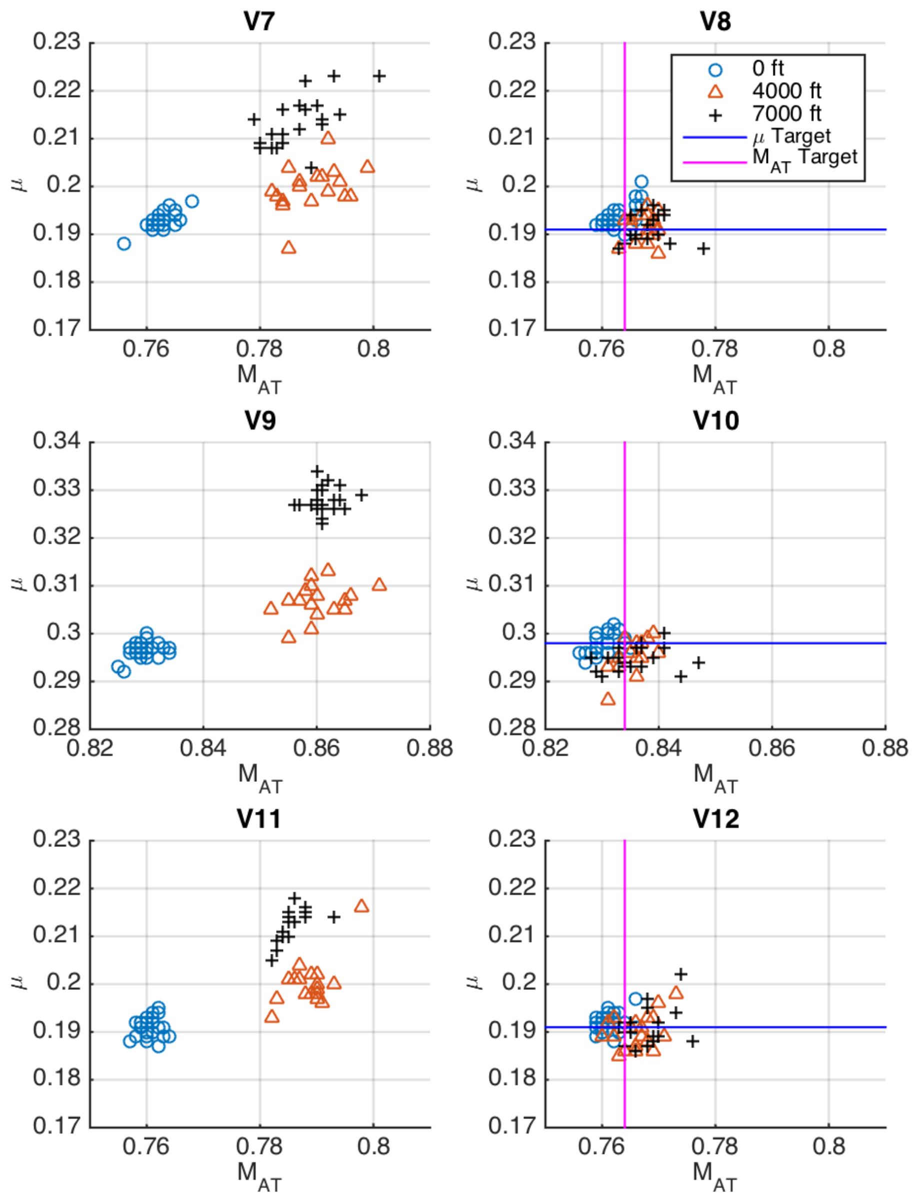


Figure 107: μ vs M_{AT} for EH-60L.

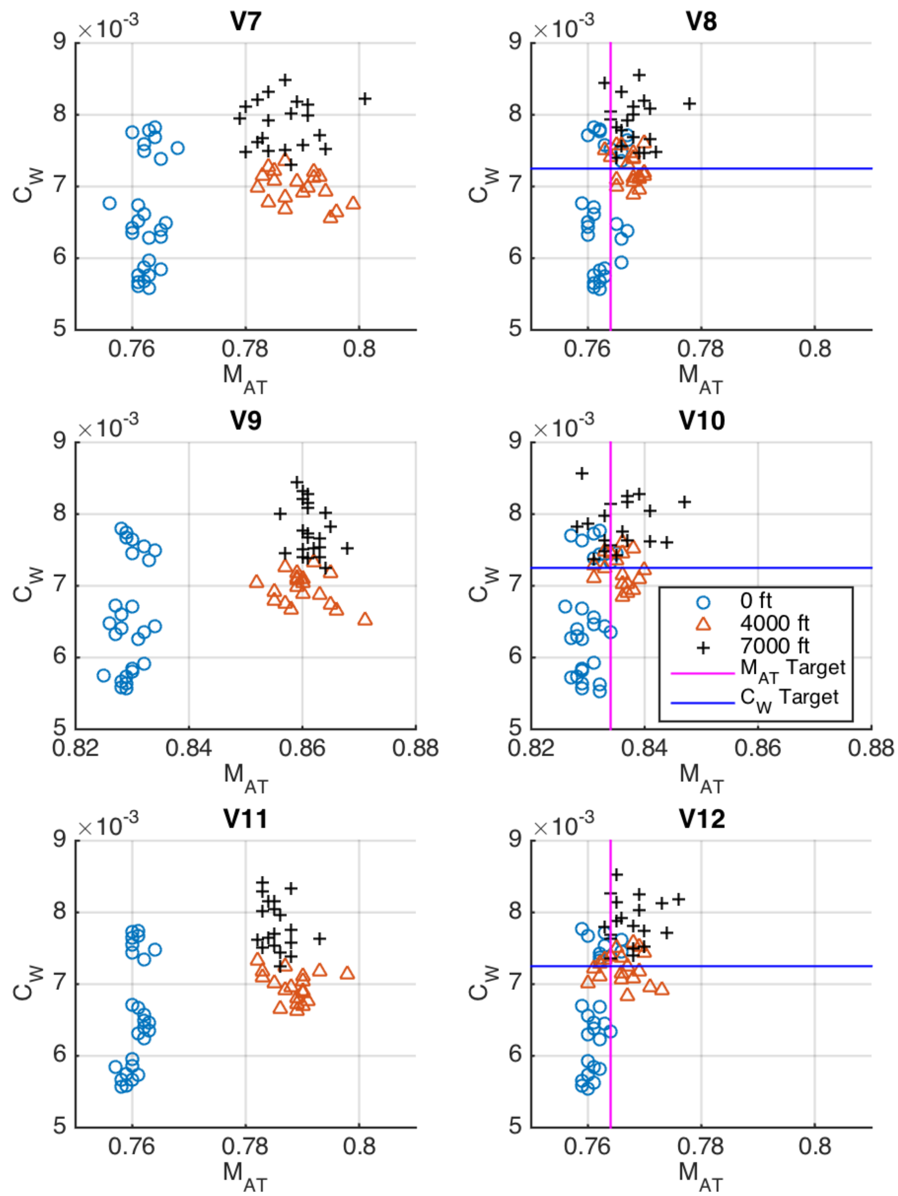


Figure 108: C_W vs M_{AT} for EH-60L.

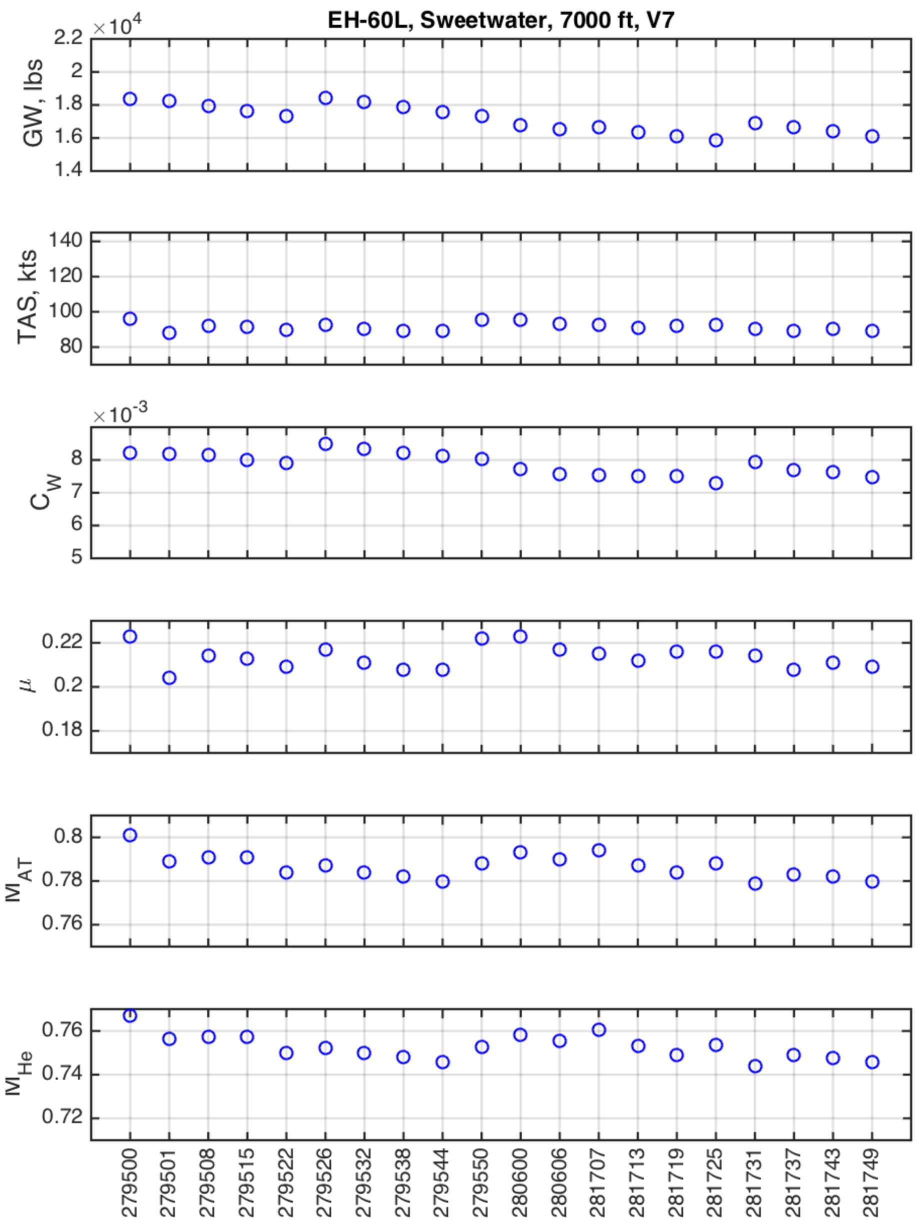


Figure 109: EH-60L aircraft parameters for Sweetwater, 7000 ft, V7 test condition.

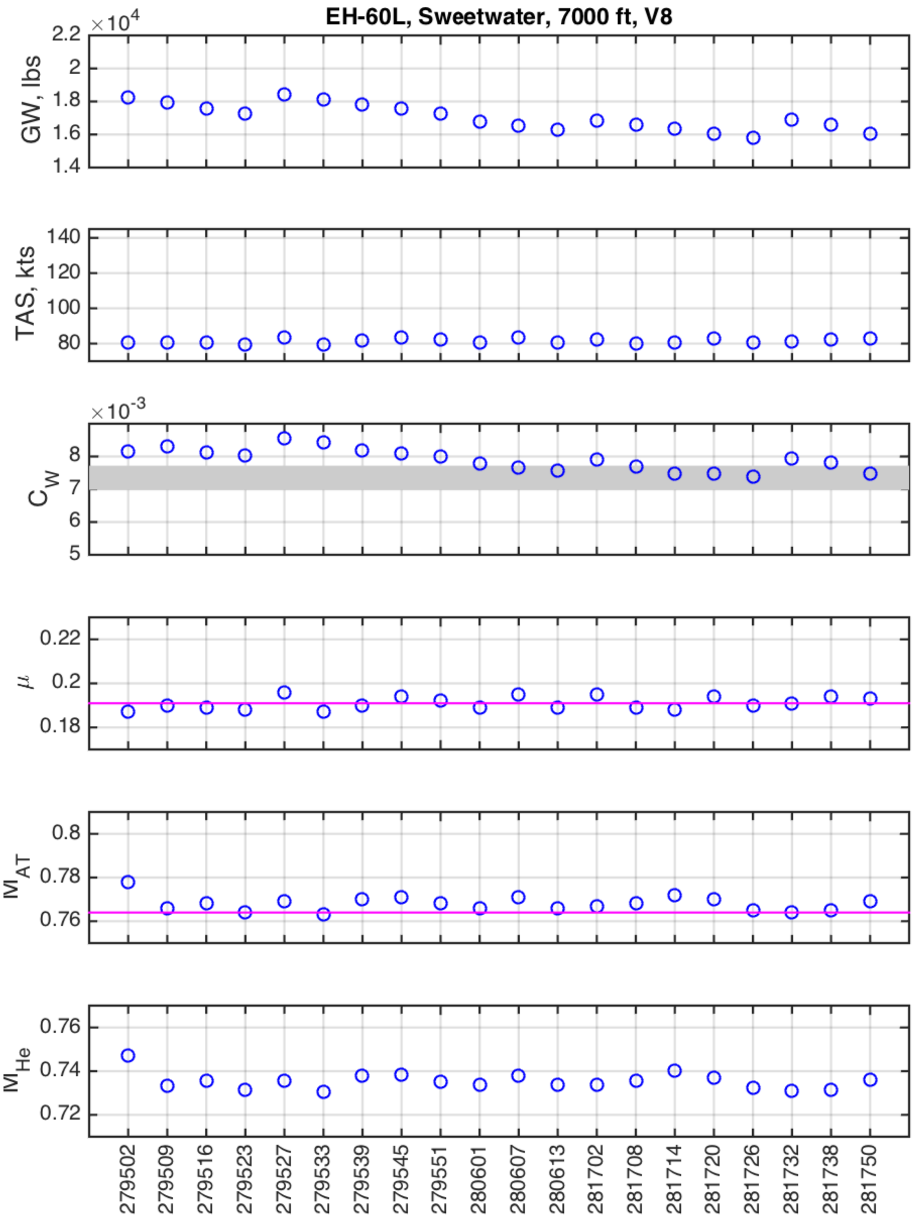


Figure 110: EH-60L aircraft parameters for Sweetwater, 7000 ft, V8 test condition. Gray box is target C_W range. Magenta lines are target μ and M_{AT}.

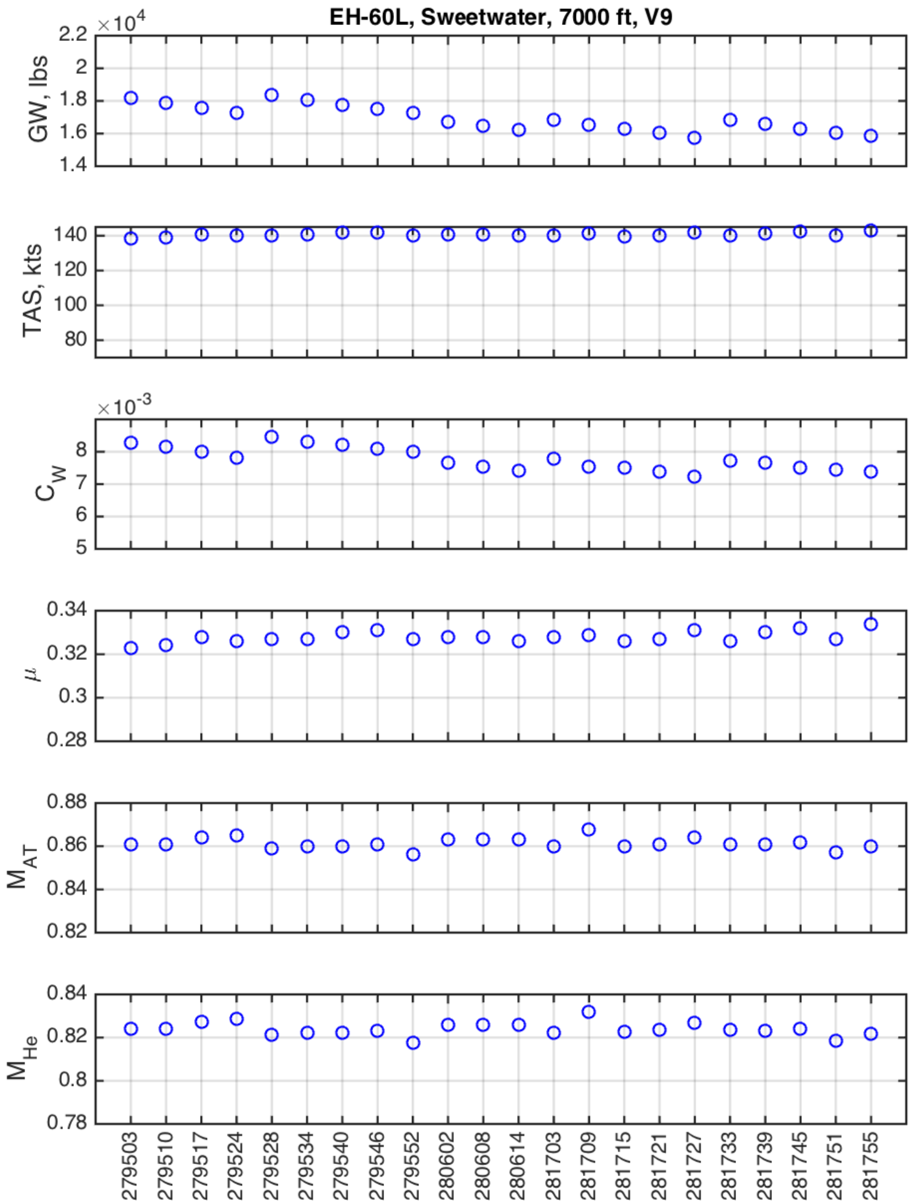


Figure 111: EH-60L aircraft parameters for Sweetwater, 7000 ft, V9 test condition.

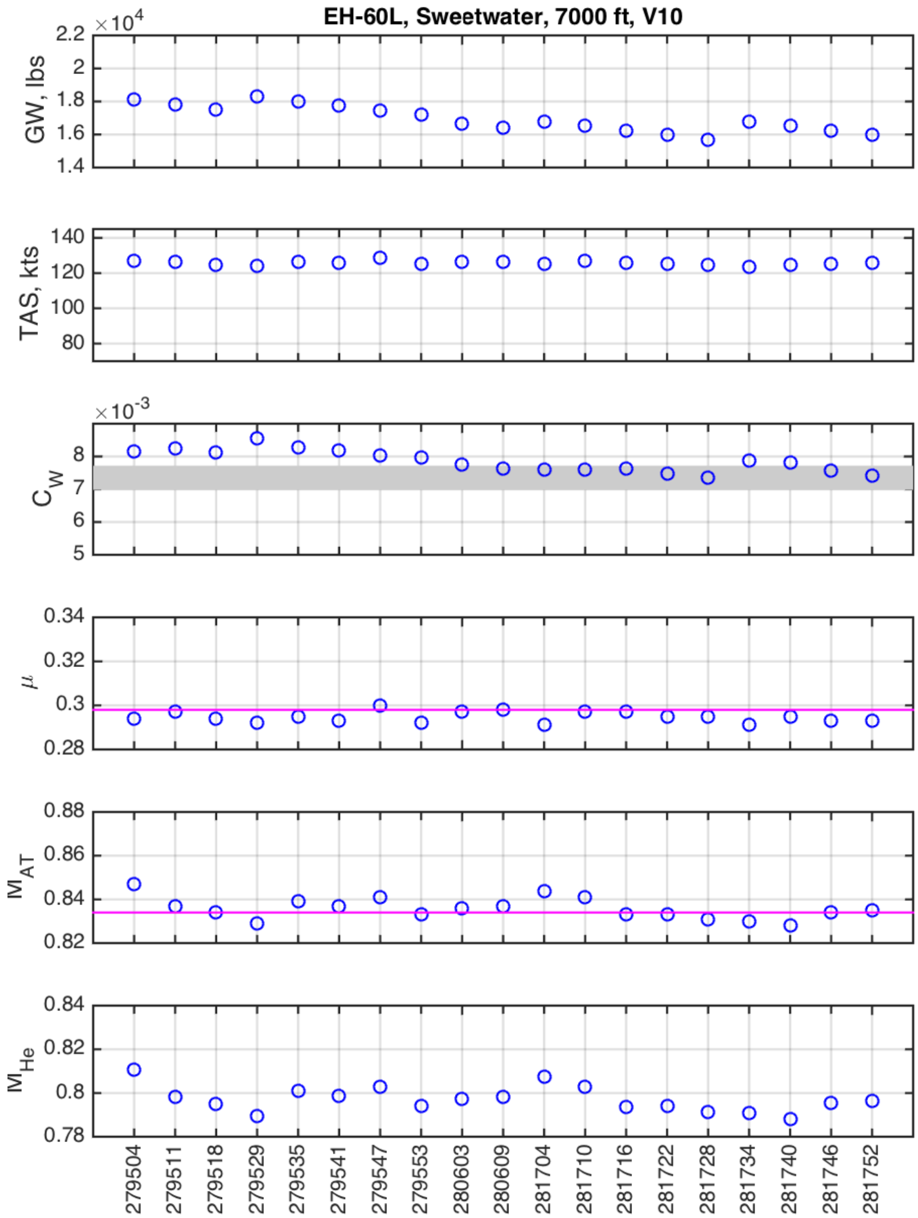


Figure 112: EH-60L aircraft parameters for Sweetwater, 7000 ft, V10 test condition. Gray box is target C_W range. Magenta lines are target μ and M_{AT}.

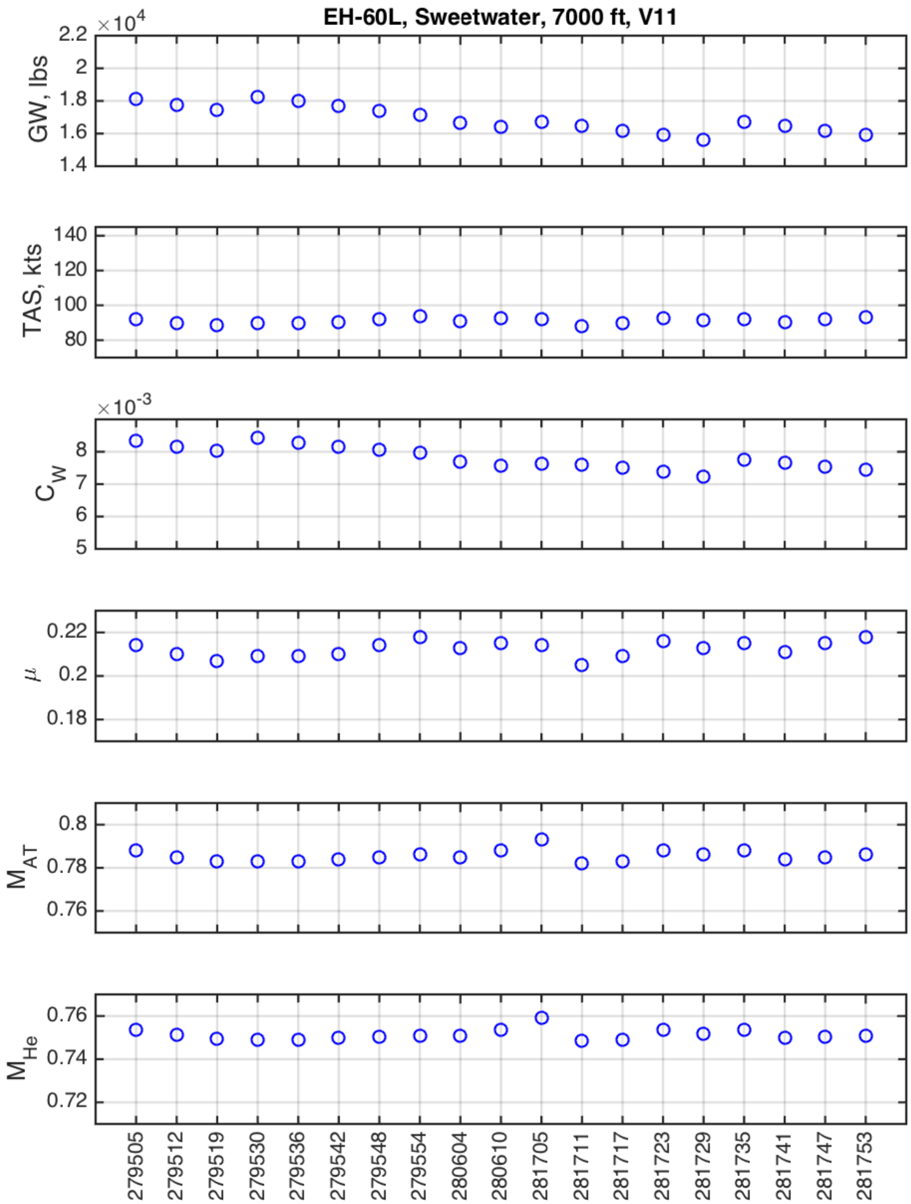


Figure 113: EH-60L aircraft parameters for Sweetwater, 7000 ft, V11 test condition.

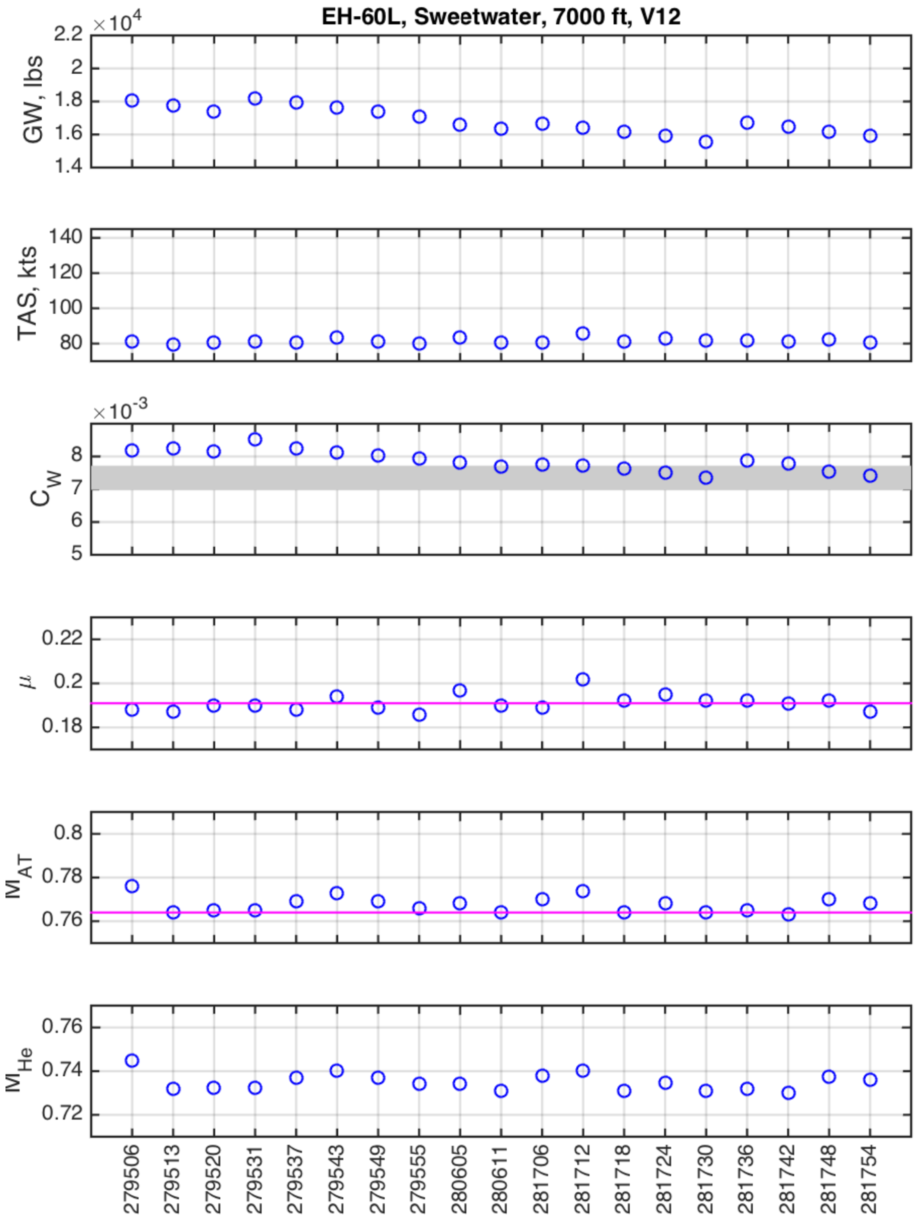


Figure 114: EH-60L aircraft parameters for Sweetwater, 7000 ft, V12 test condition. Gray box is target C_W range. Magenta lines are target μ and M_{AT}.

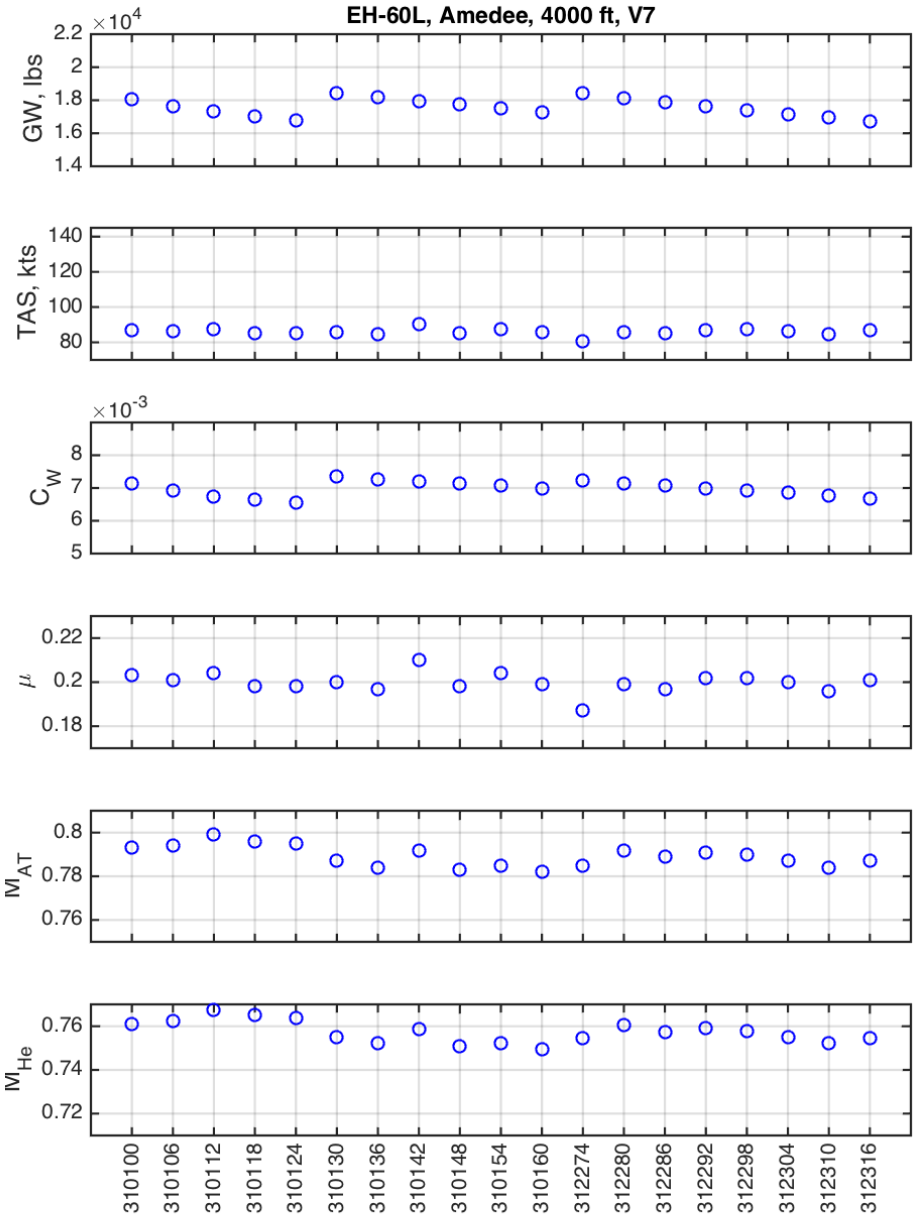


Figure 115: EH-60L aircraft parameters for Amedee, 4000 ft, V7 test condition.

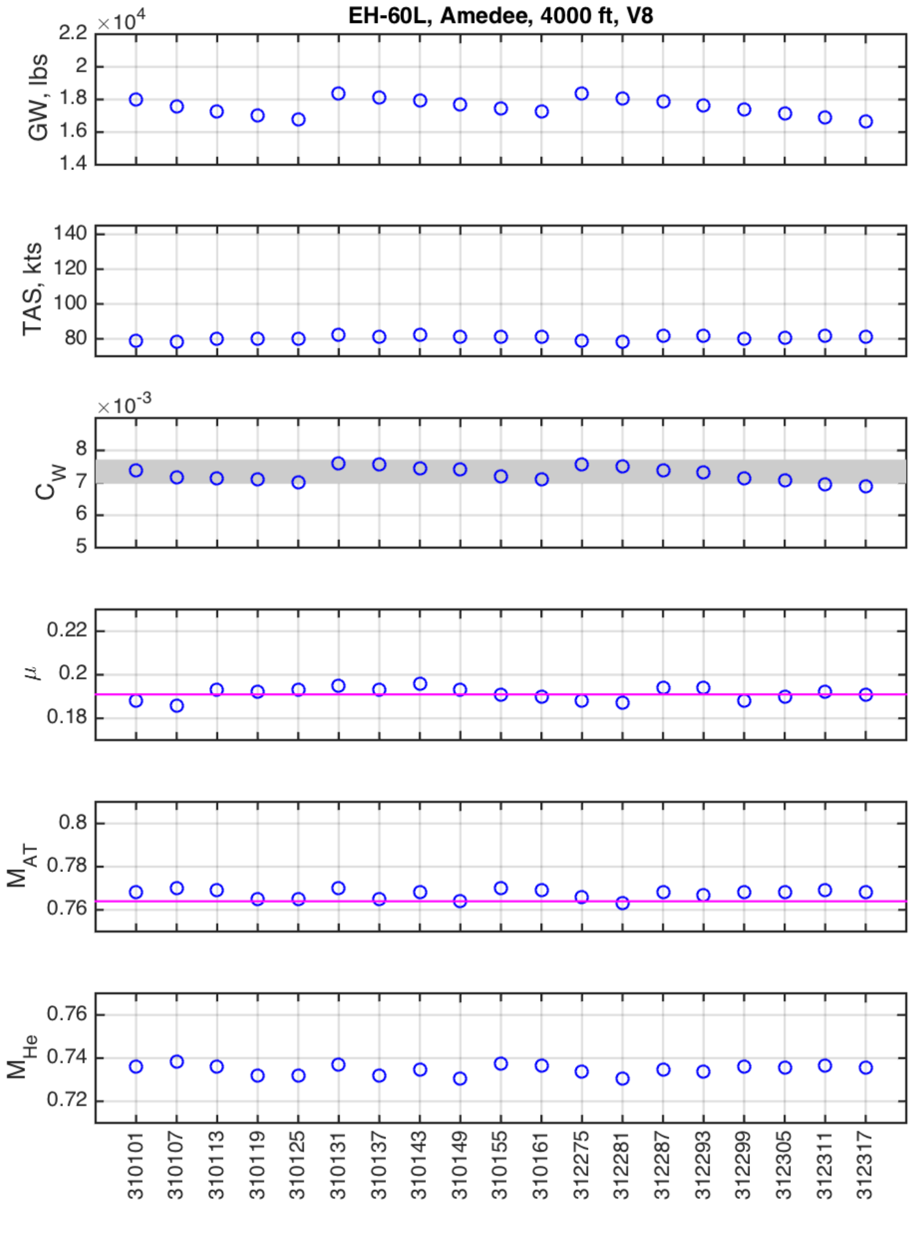


Figure 116: EH-60L aircraft parameters for Amedee, 4000 ft, V8 test condition. Gray box is target C_W range. Magenta lines are target μ and M_{AT}.

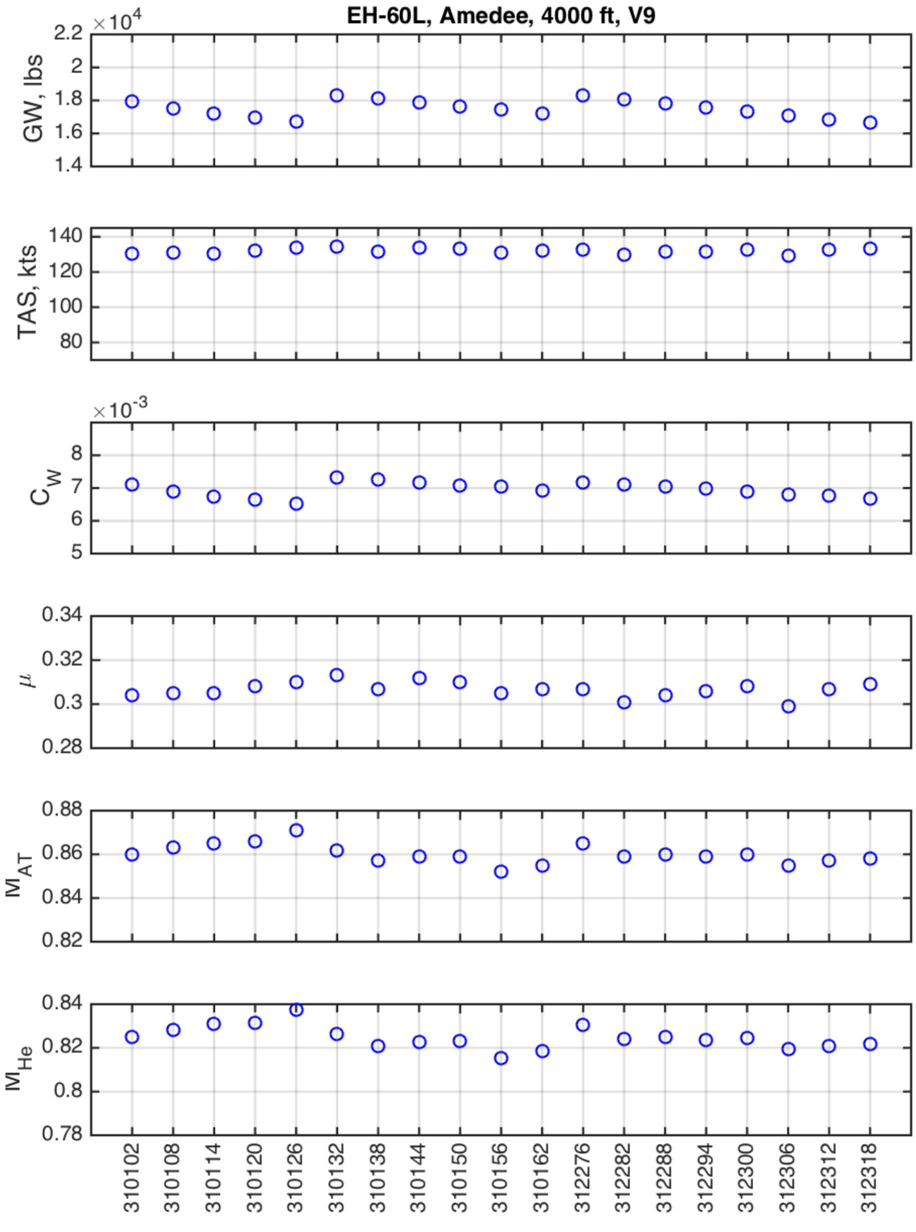


Figure 117: EH-60L aircraft parameters for Amedee, 4000 ft, V9 test condition.

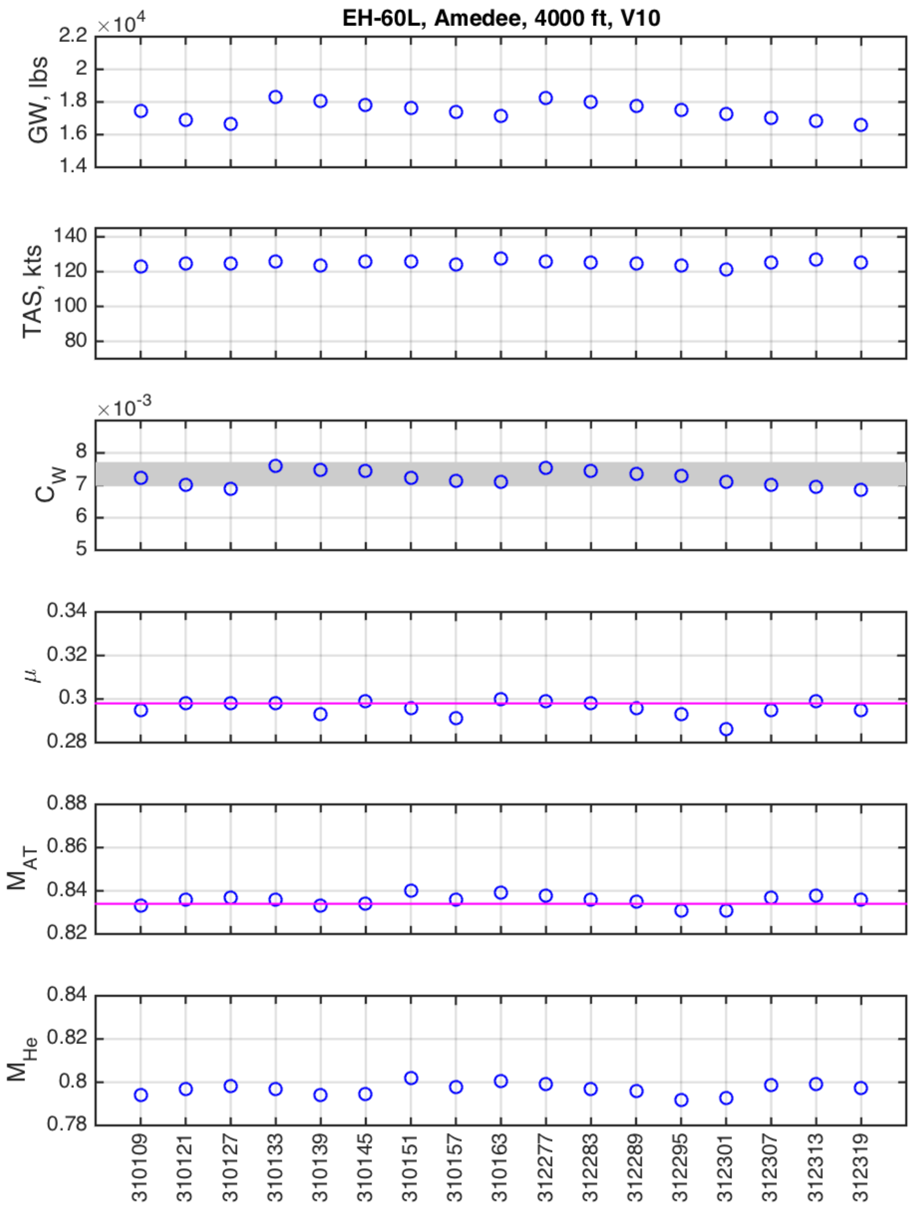


Figure 118: EH-60L aircraft parameters for Amedee, 4000 ft, V10 test condition. Gray box is target C_W range. Magenta lines are target μ and M_{AT}.

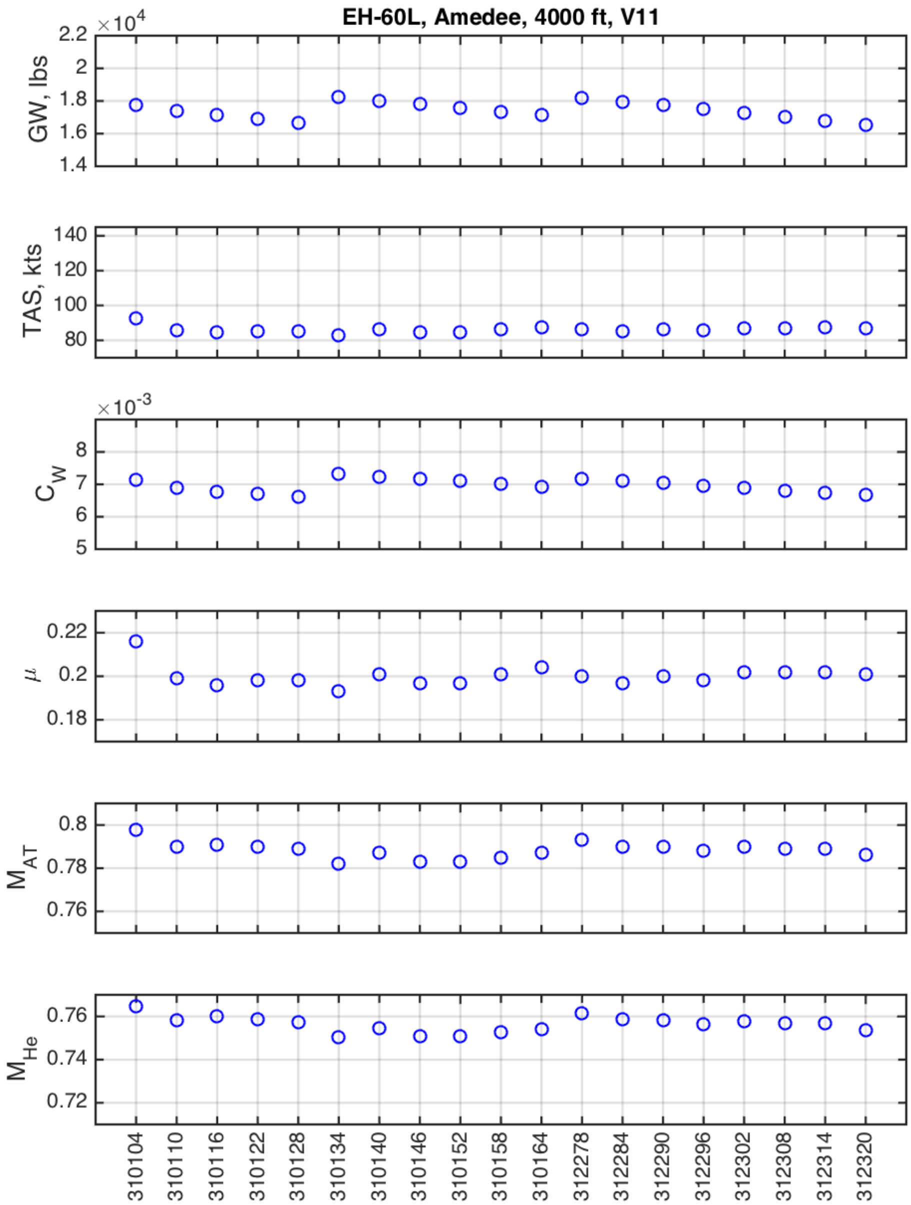


Figure 119: EH-60L aircraft parameters for Amedee, 4000 ft, V11 test condition.

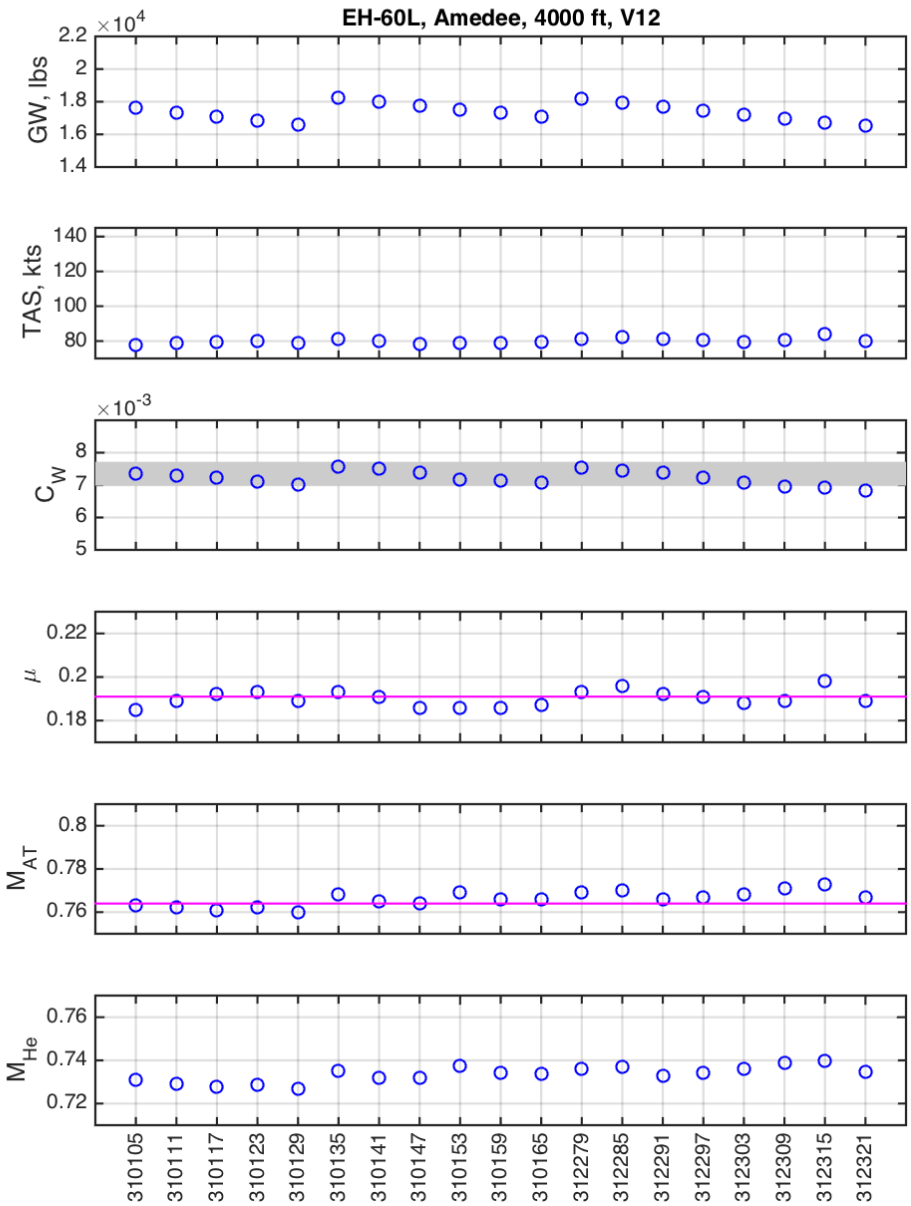


Figure 120: EH-60L aircraft parameters for Amedee, 4000 ft, V12 test condition. Gray box is target C_W range. Magenta lines are target μ and M_{AT}.

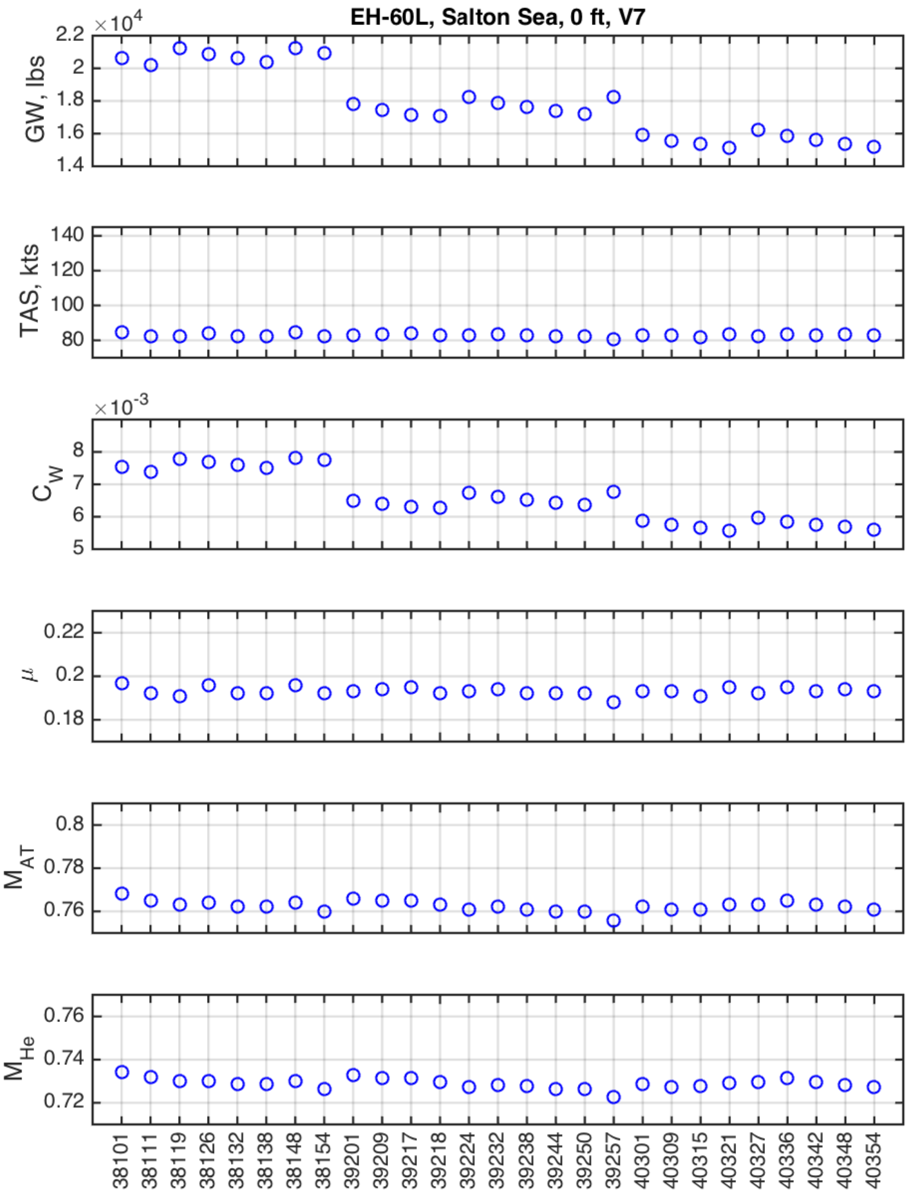


Figure 121: EH-60L aircraft parameters for Salton Sea, 0 ft, V7 test condition.

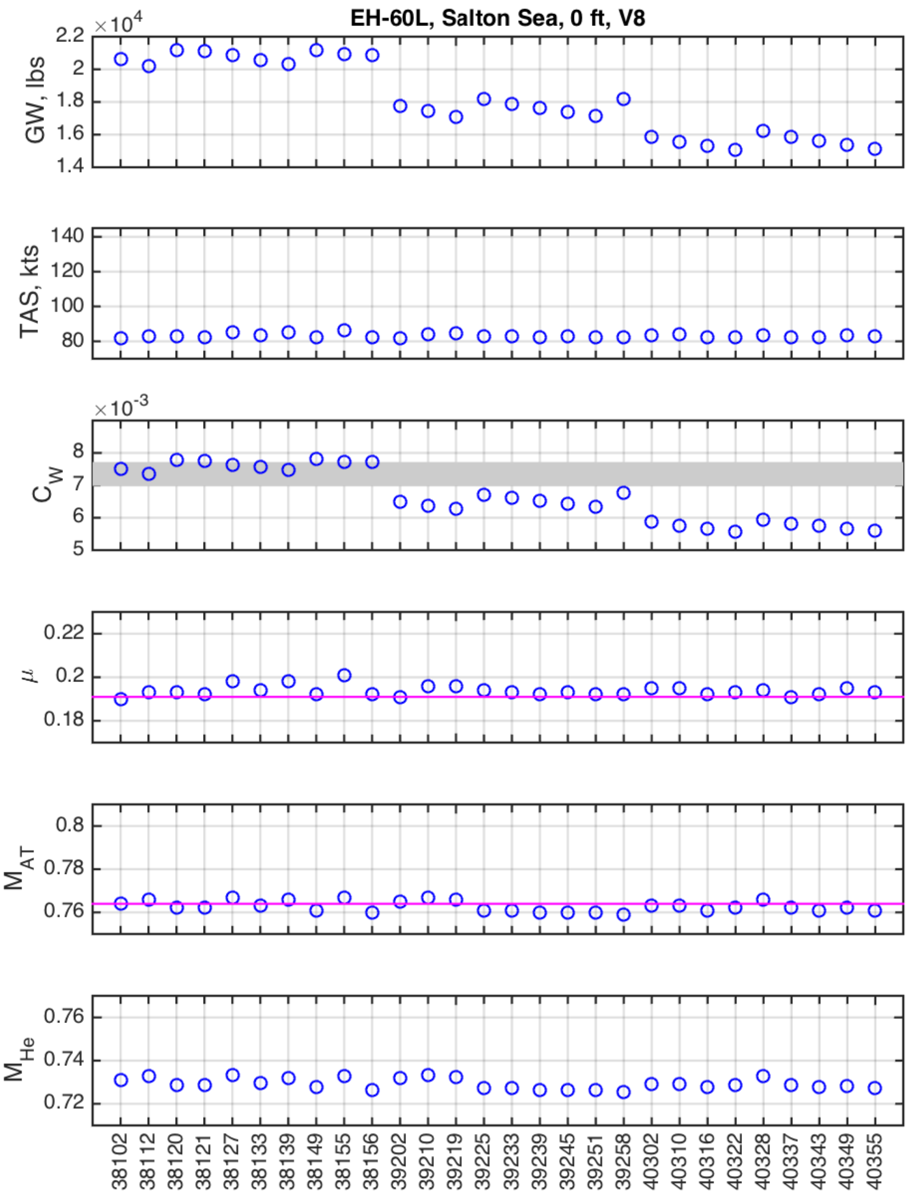


Figure 122: EH-60L aircraft parameters for Salton Sea, 0 ft, V8 test condition. Gray box is target C_W range. Magenta lines are target μ and M_{AT}.

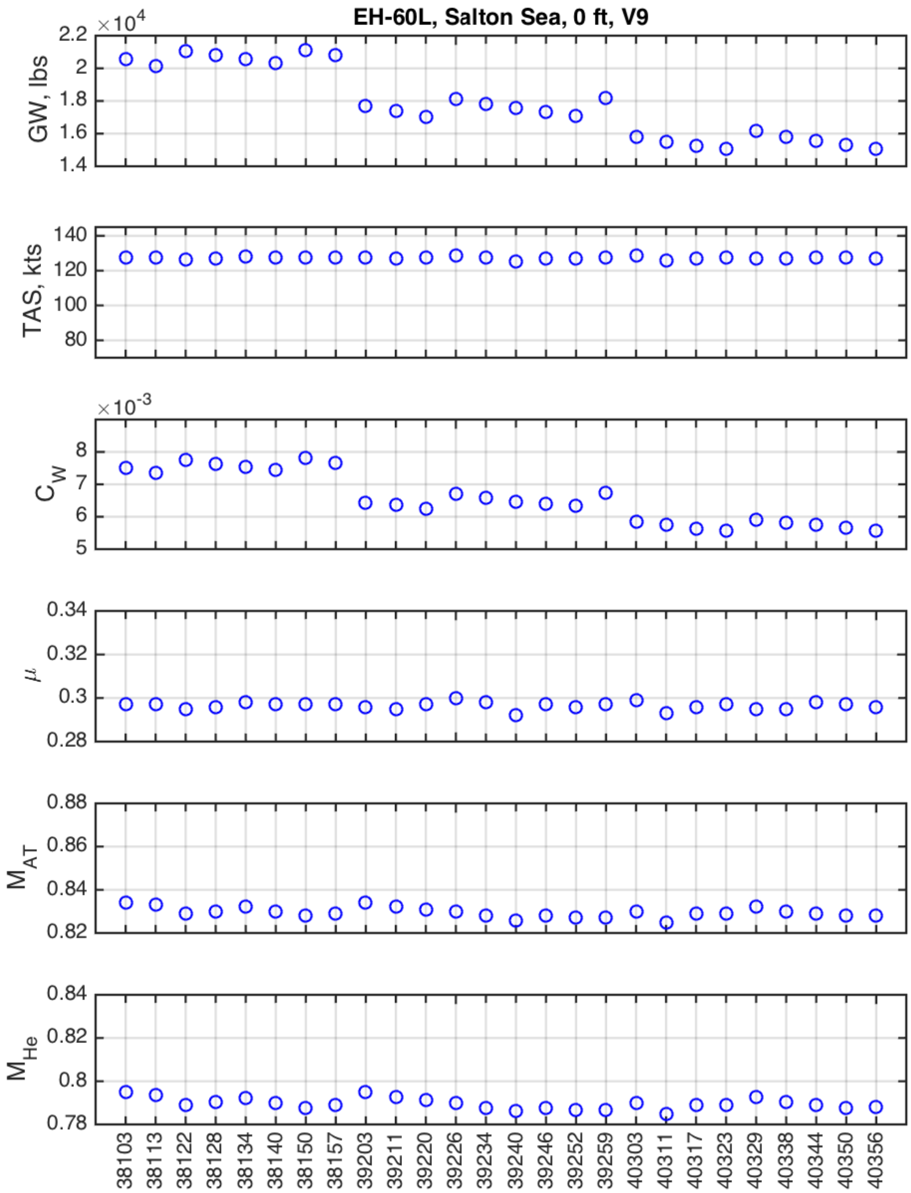


Figure 123: EH-60L aircraft parameters for Salton Sea, 0 ft, V9 test condition.

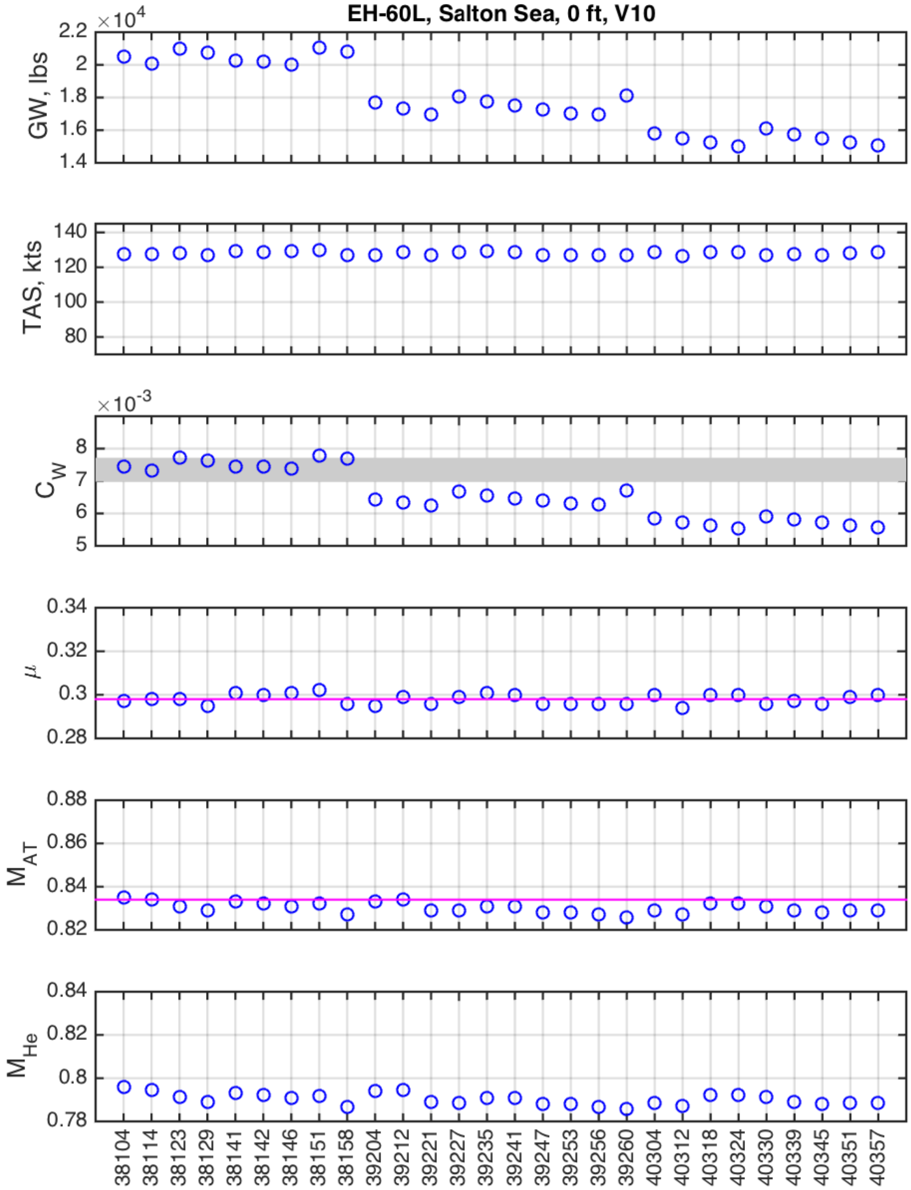


Figure 124: EH-60L aircraft parameters for Salton Sea, 0 ft, V10 test condition. Gray box is target C_W range. Magenta lines are target μ and M_{AT}.

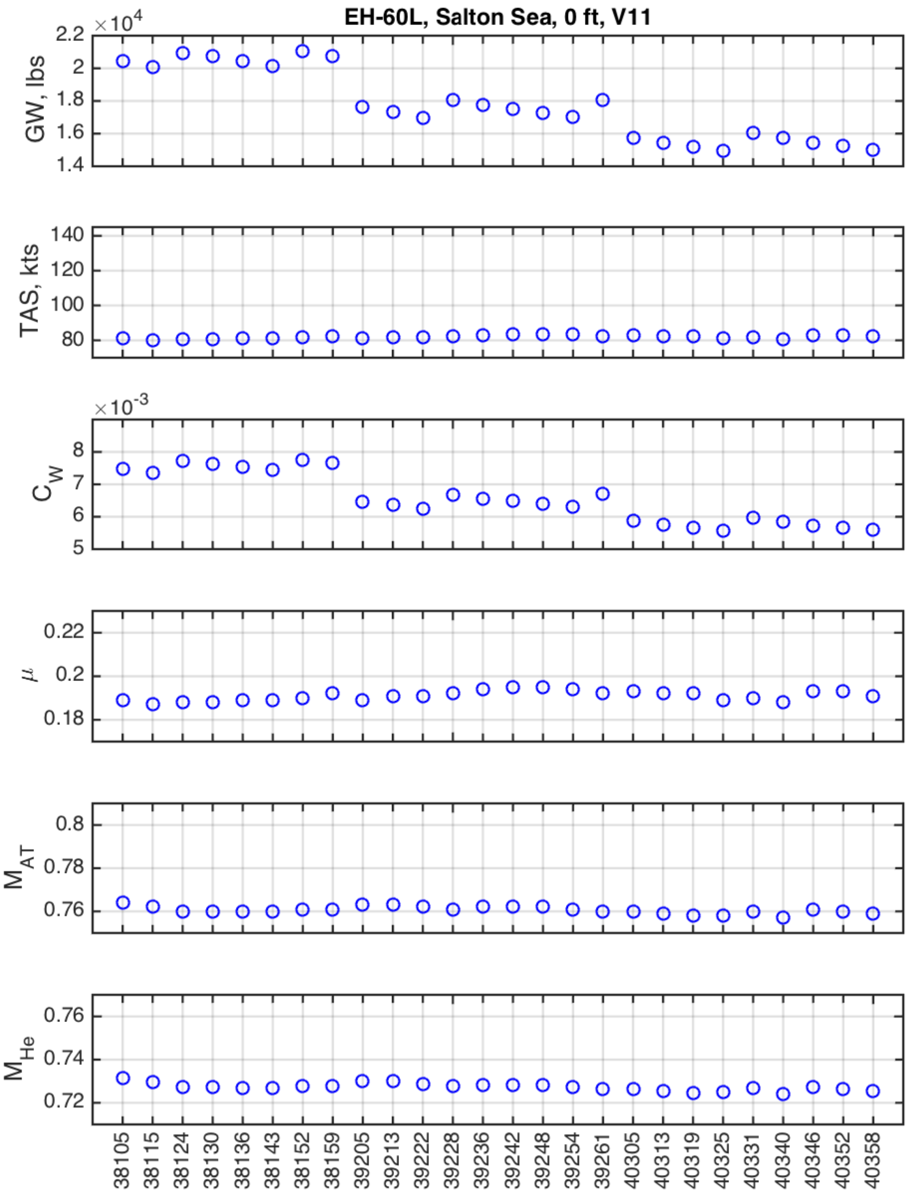


Figure 125: EH-60L aircraft parameters for Salton Sea, 0 ft, V11 test condition.

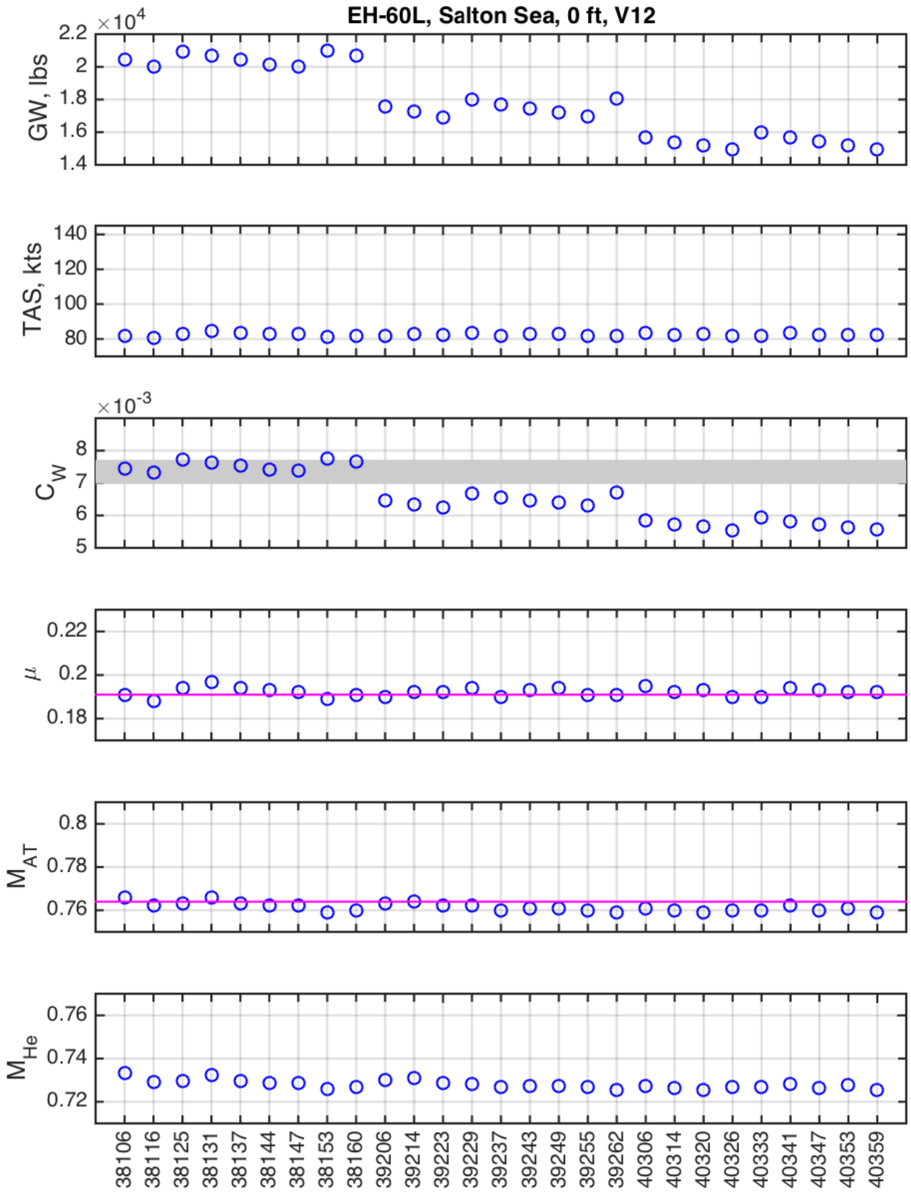


Figure 126: EH-60L aircraft parameters for Salton Sea, 0 ft, V12 test condition. Gray box is target C_W range. Magenta lines are target μ and M_{AT}.

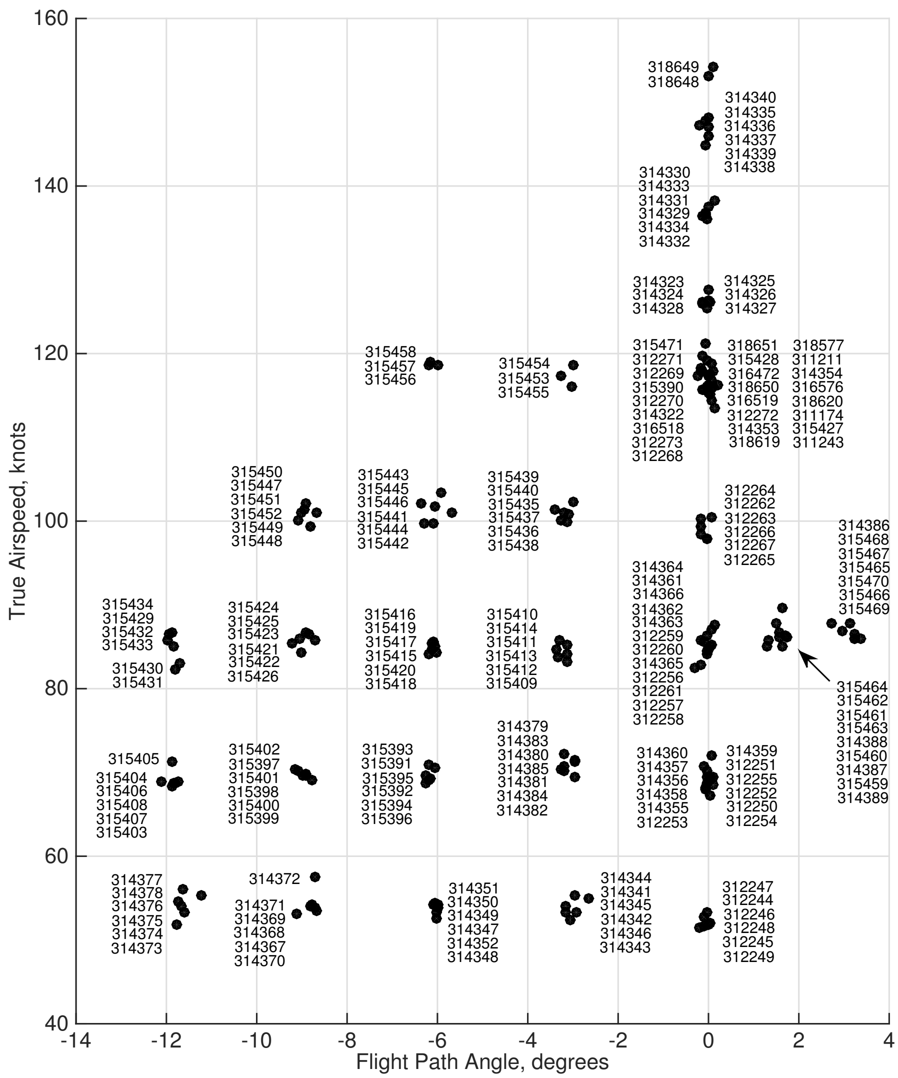


Figure 127: True airspeed vs flight path angle for EH-60L A and L conditions.

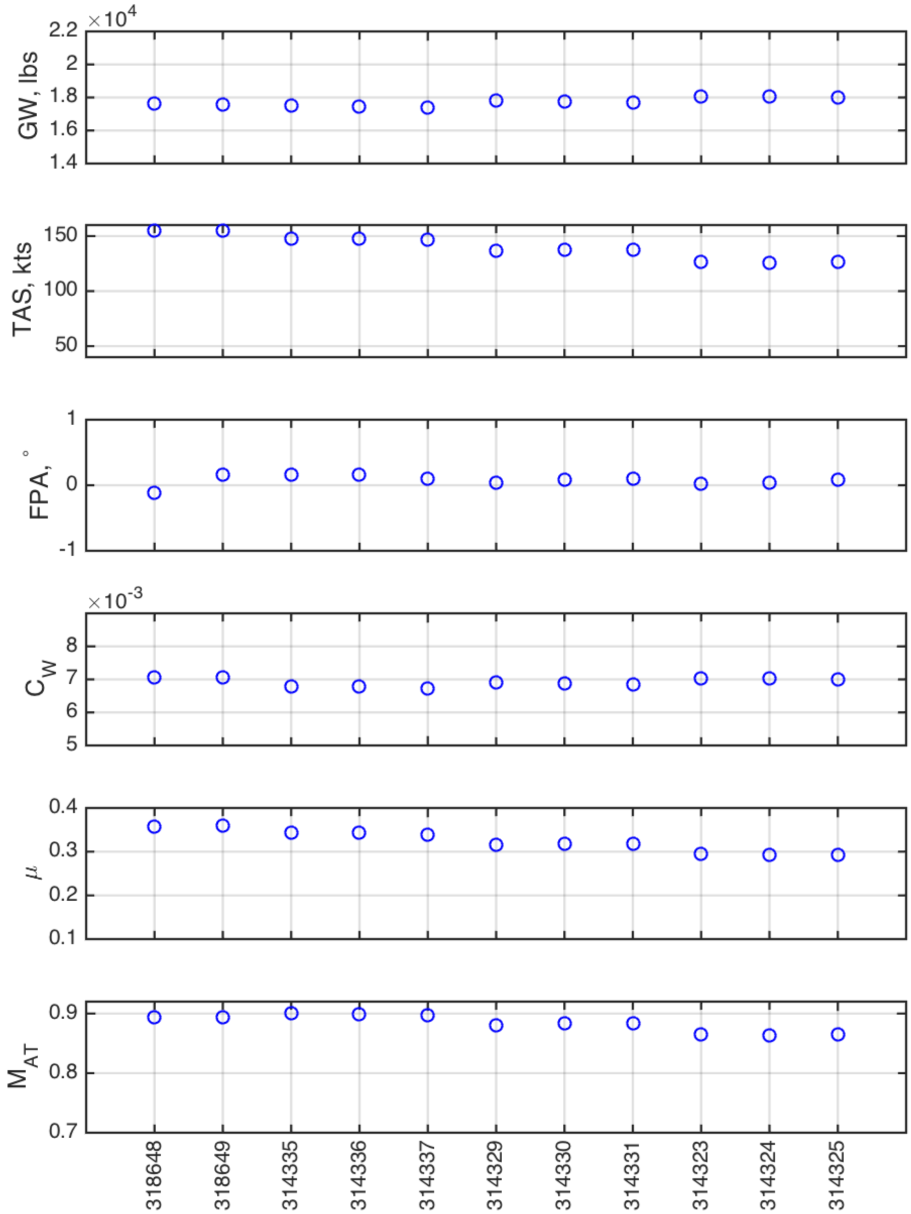


Figure 128: EH-60L L0 to L3 condition aircraft parameters.

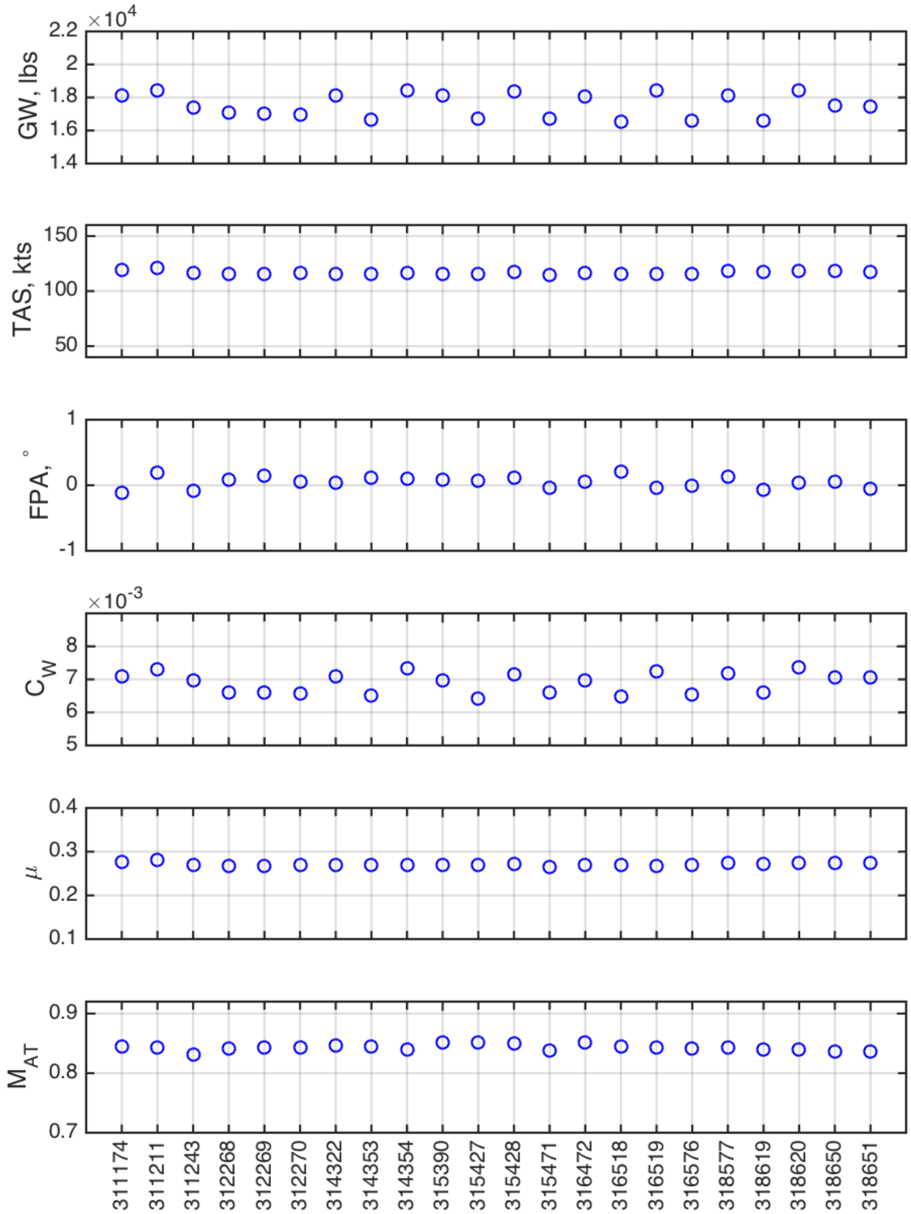


Figure 129: EH-60L L4 condition aircraft parameters.

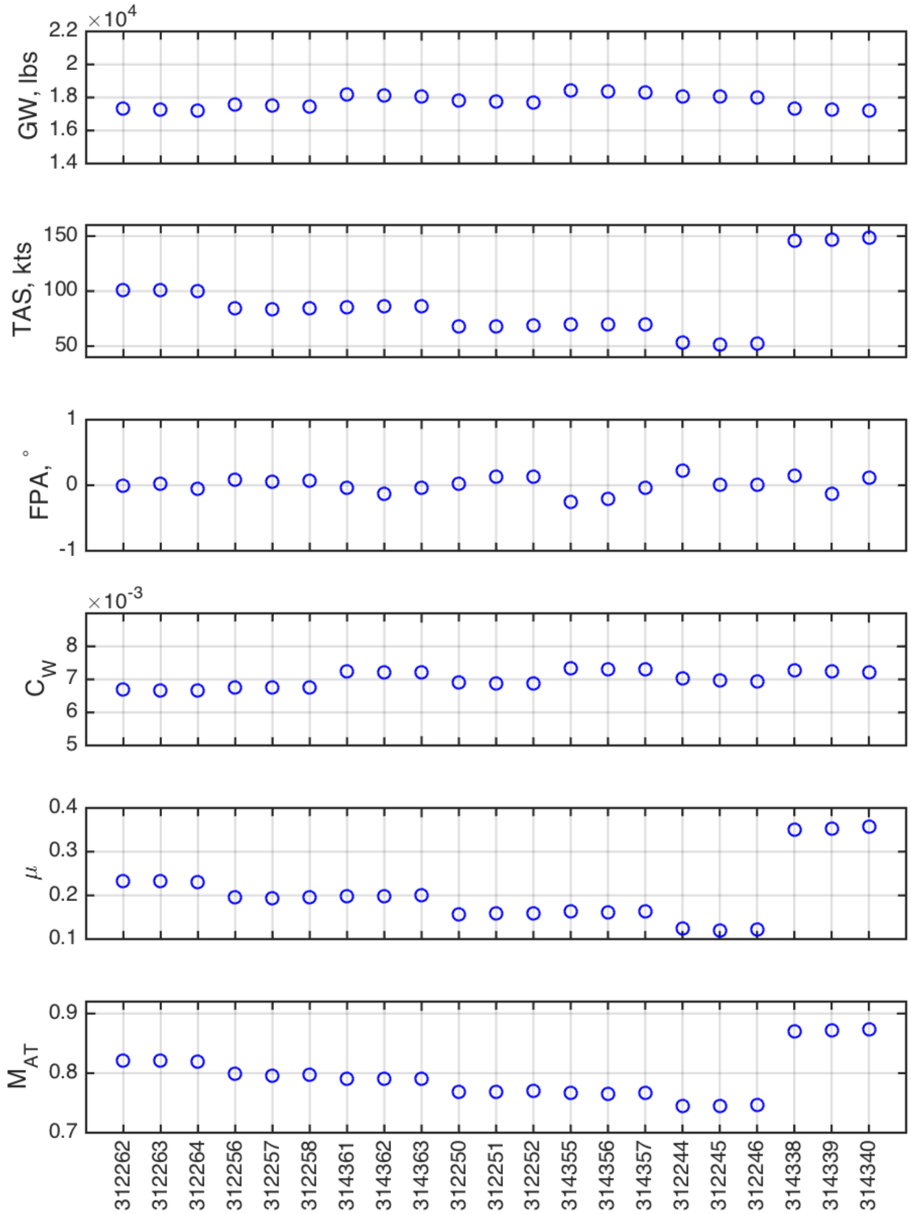


Figure 130: EH-60L L5 to L9 condition aircraft parameters.

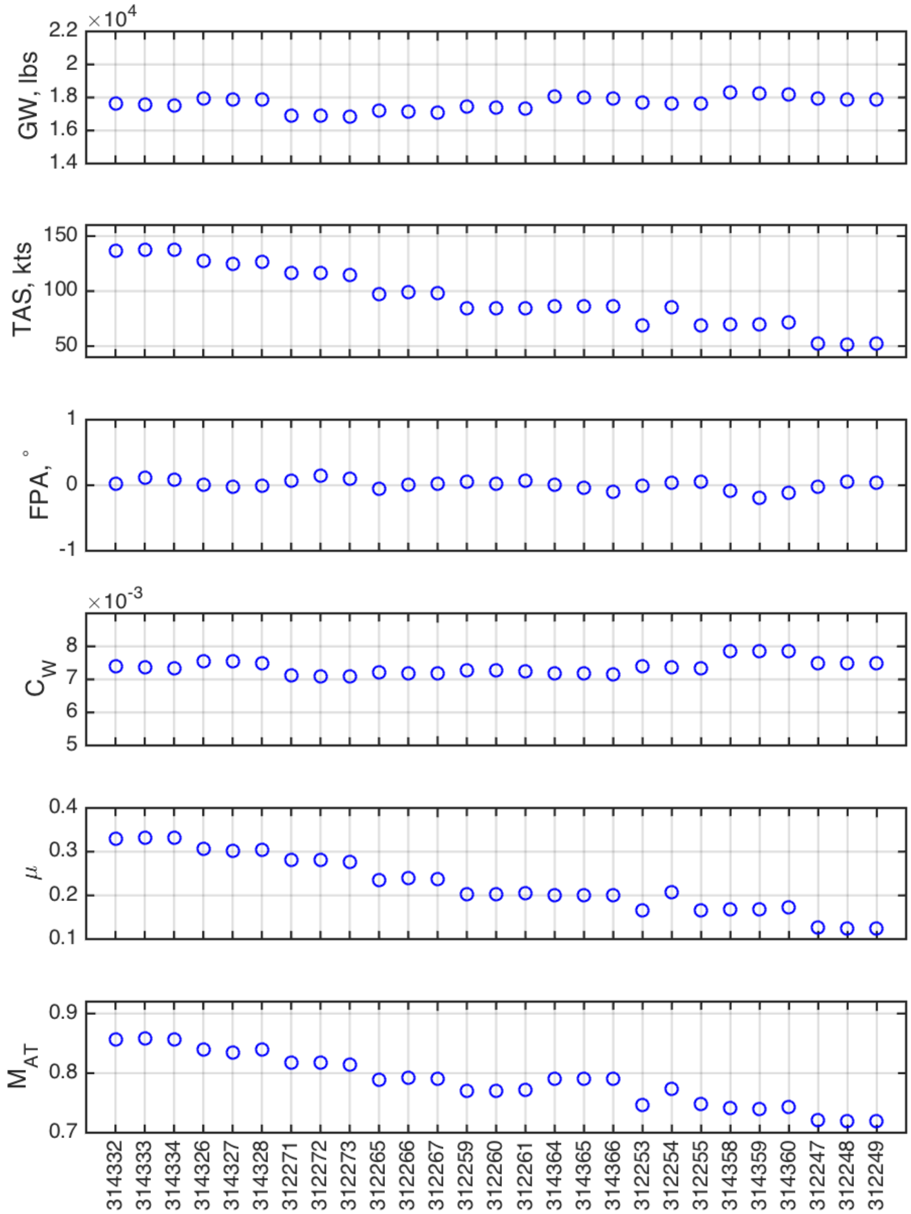


Figure 131: EH-60L L10 to L16 condition aircraft parameters.

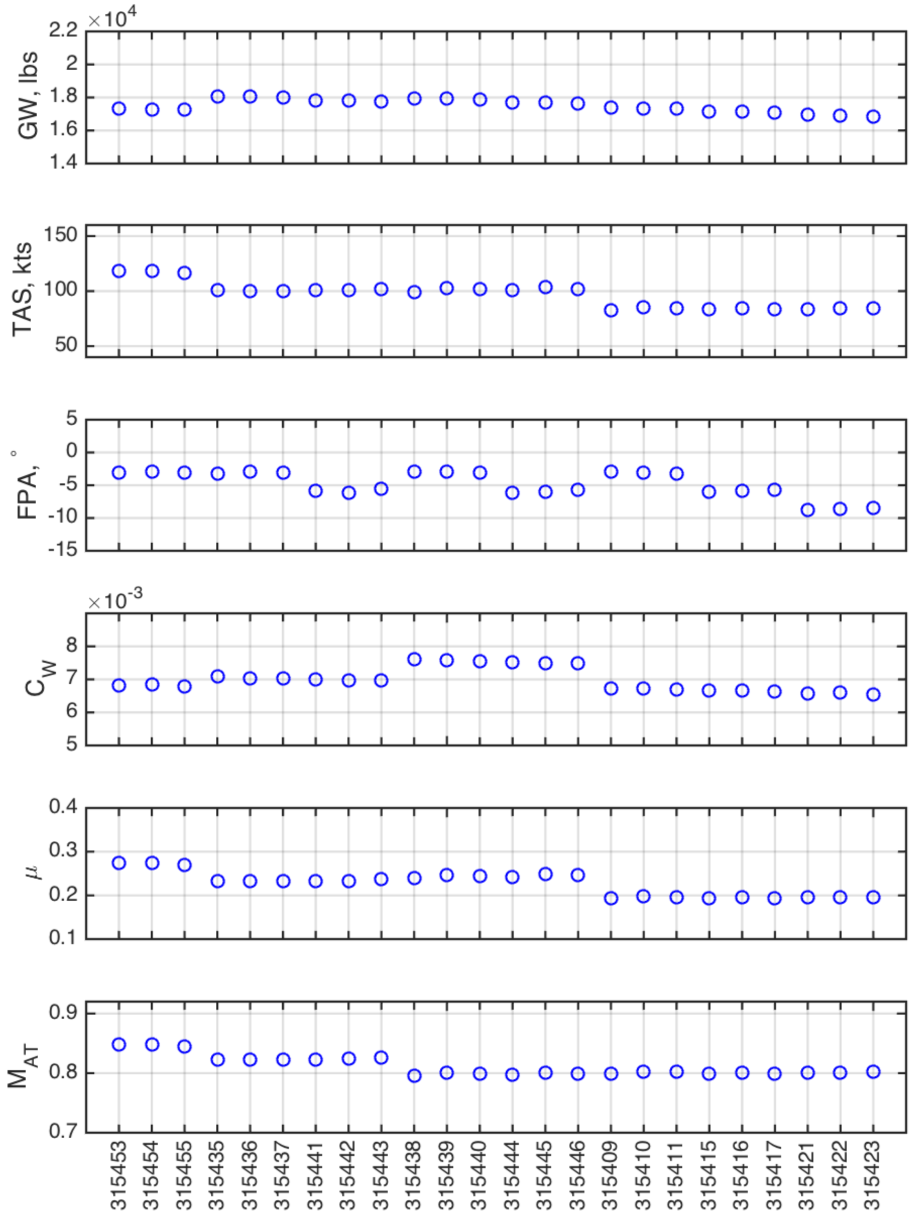


Figure 132: EH-60L A1 to A9 condition aircraft parameters.

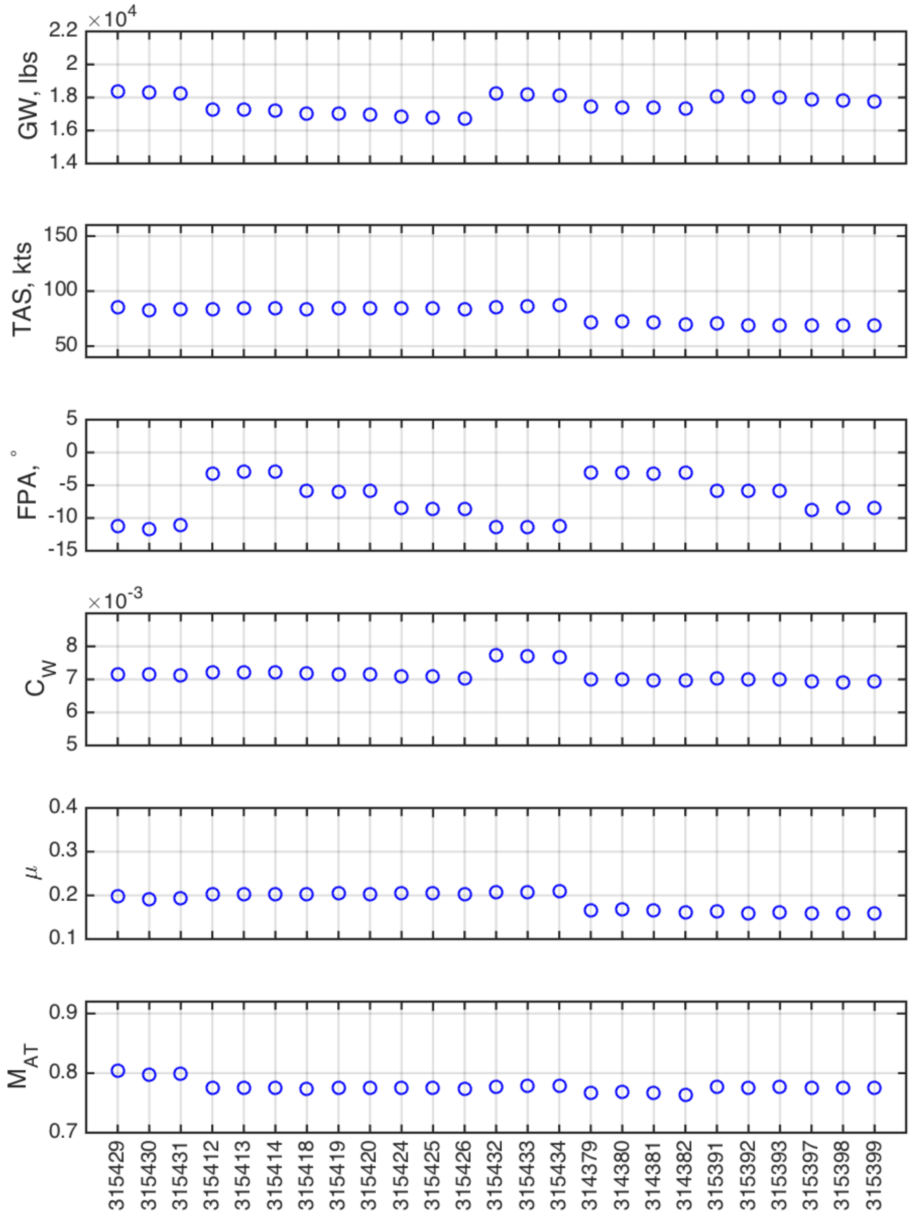


Figure 133: EH-60L A10 to A17 condition aircraft parameters.

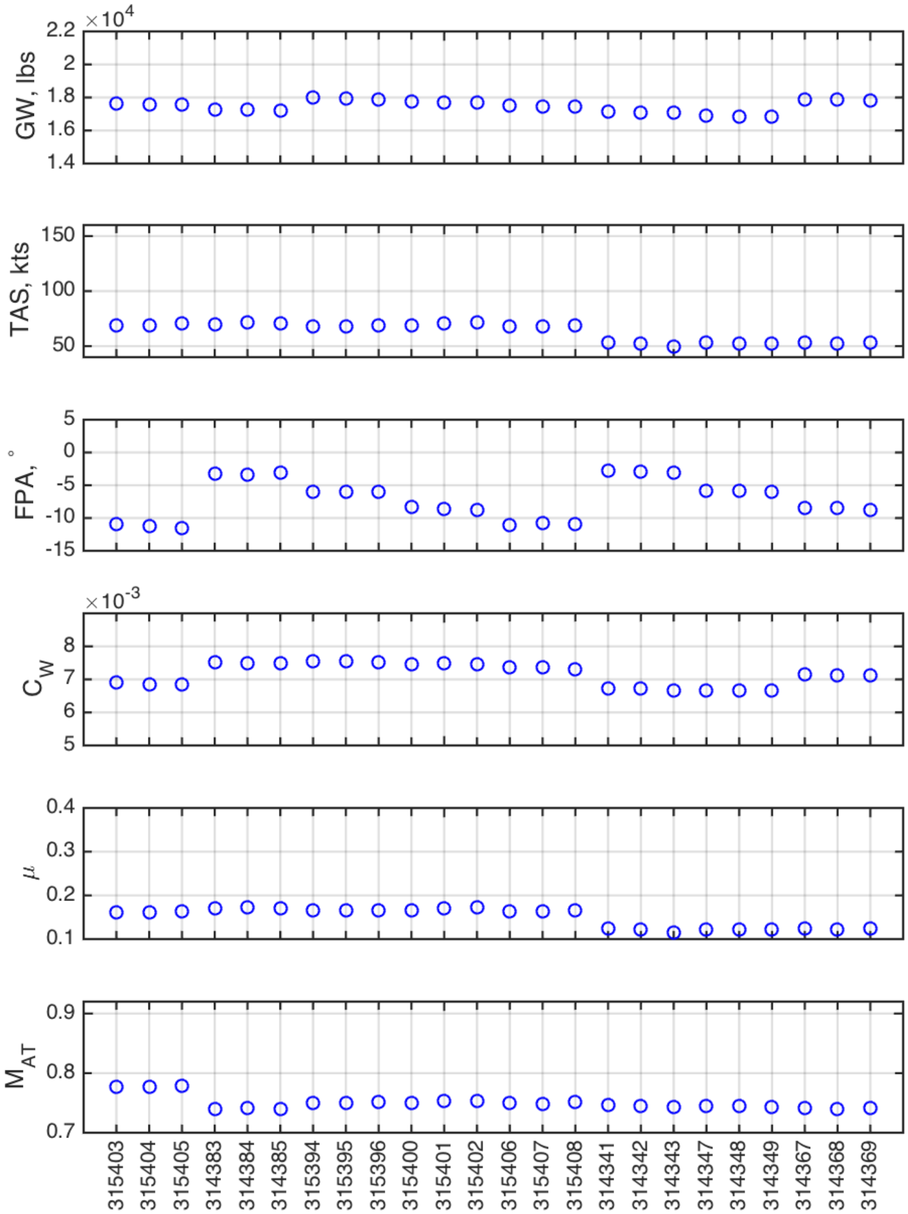


Figure 134: EH-60L A18 to A25 condition aircraft parameters.

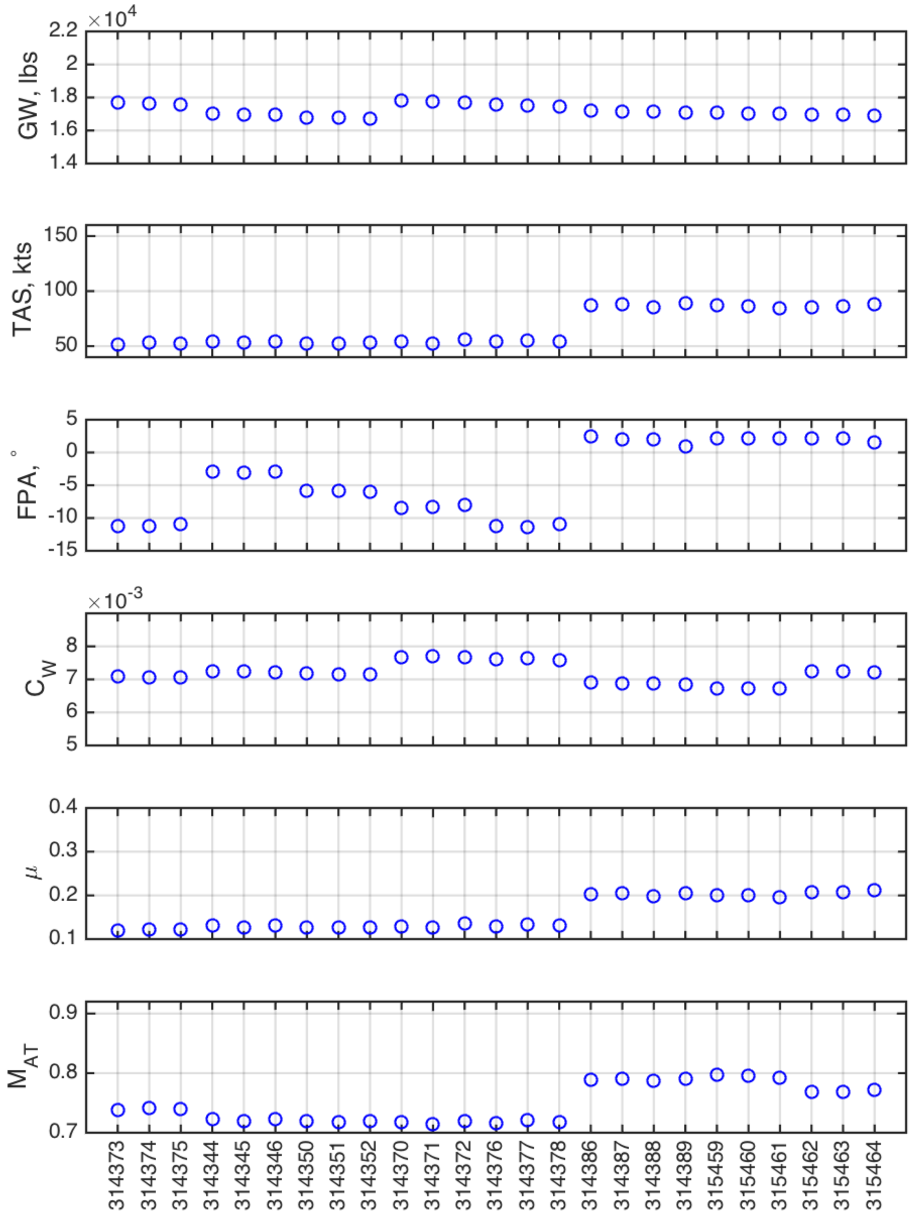


Figure 135: EH-60L A26 to A32 condition aircraft parameters.

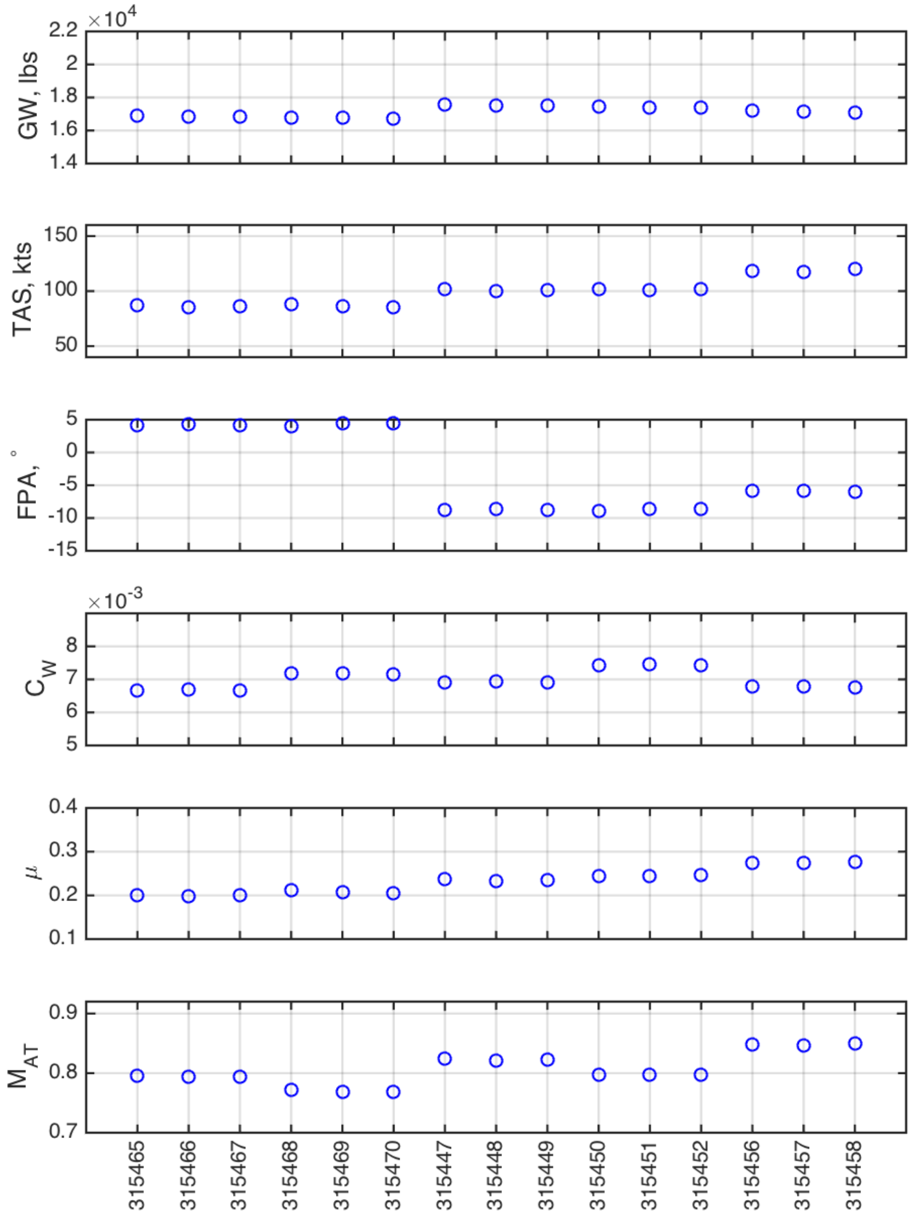


Figure 136: EH-60L A33 to A37 condition aircraft parameters.

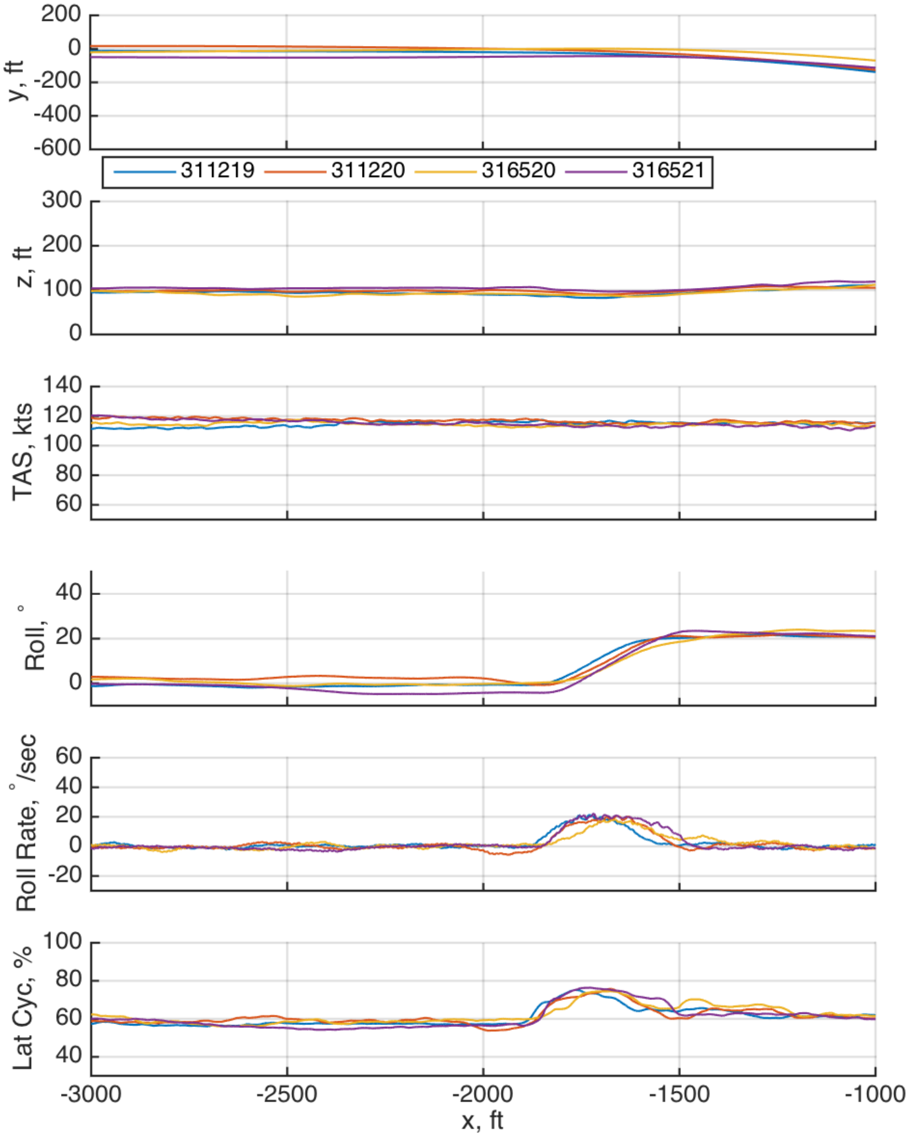


Figure 137: EH-60L M1 test condition, 110 knots, level 20° right bank.

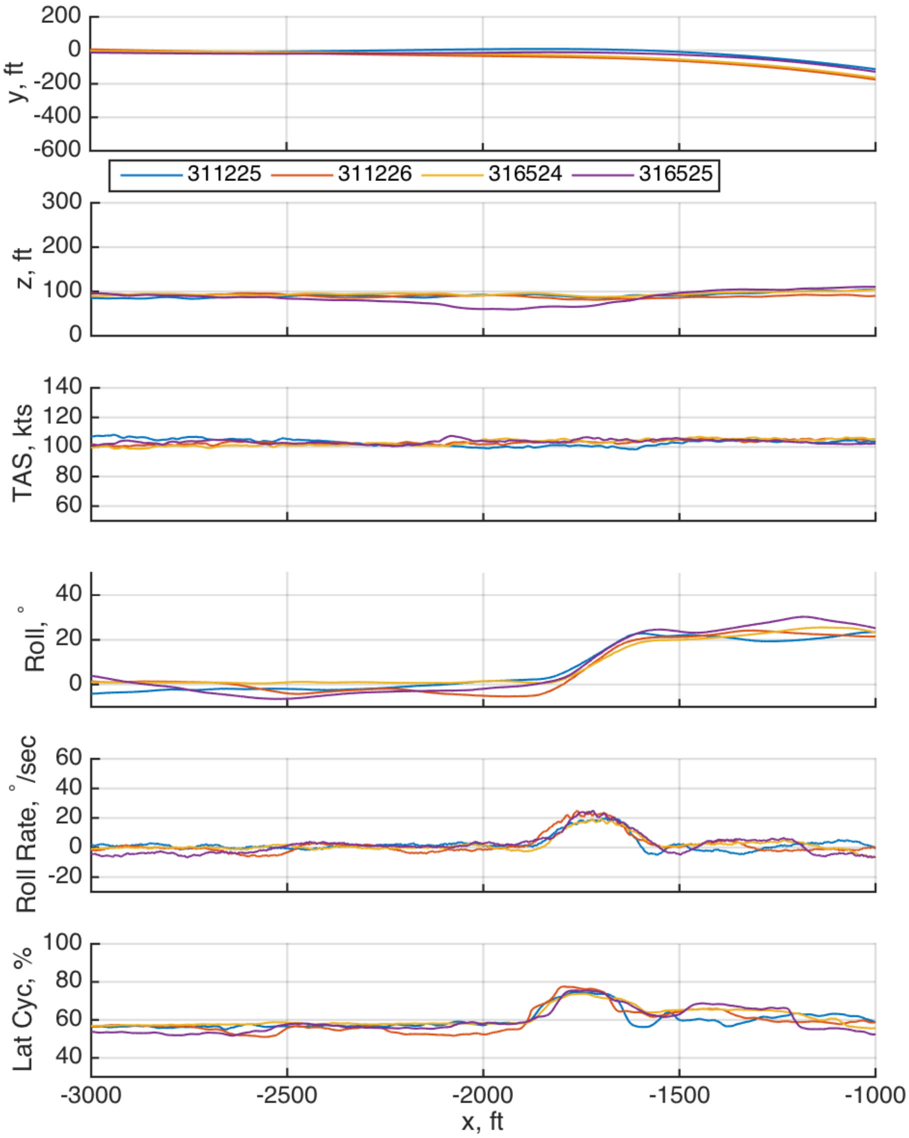


Figure 138: EH-60L M2 test condition, 95 knots, level 20° right bank.

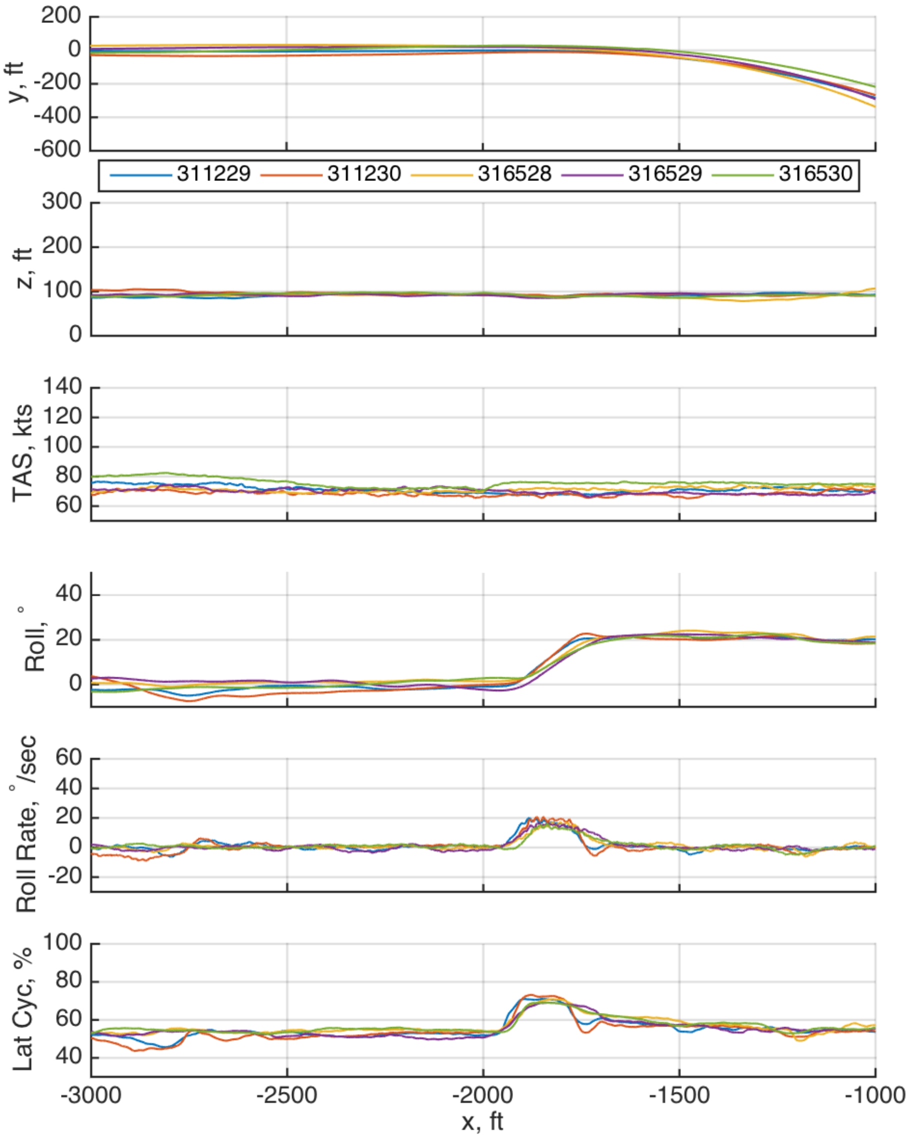


Figure 139: EH-60L M3 test condition, 65 knots, level 20° right bank.

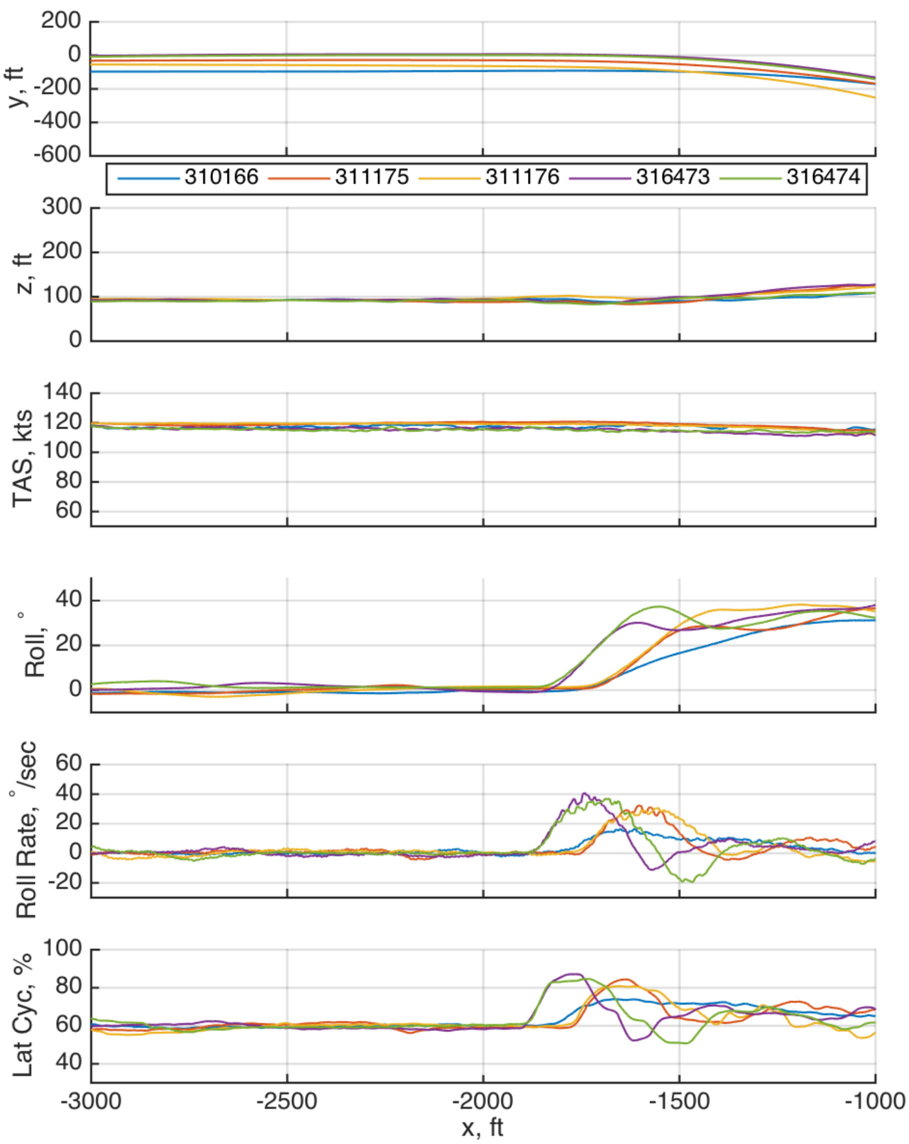


Figure 140: EH-60L M4 test condition, 110 knots, level 30° right bank.

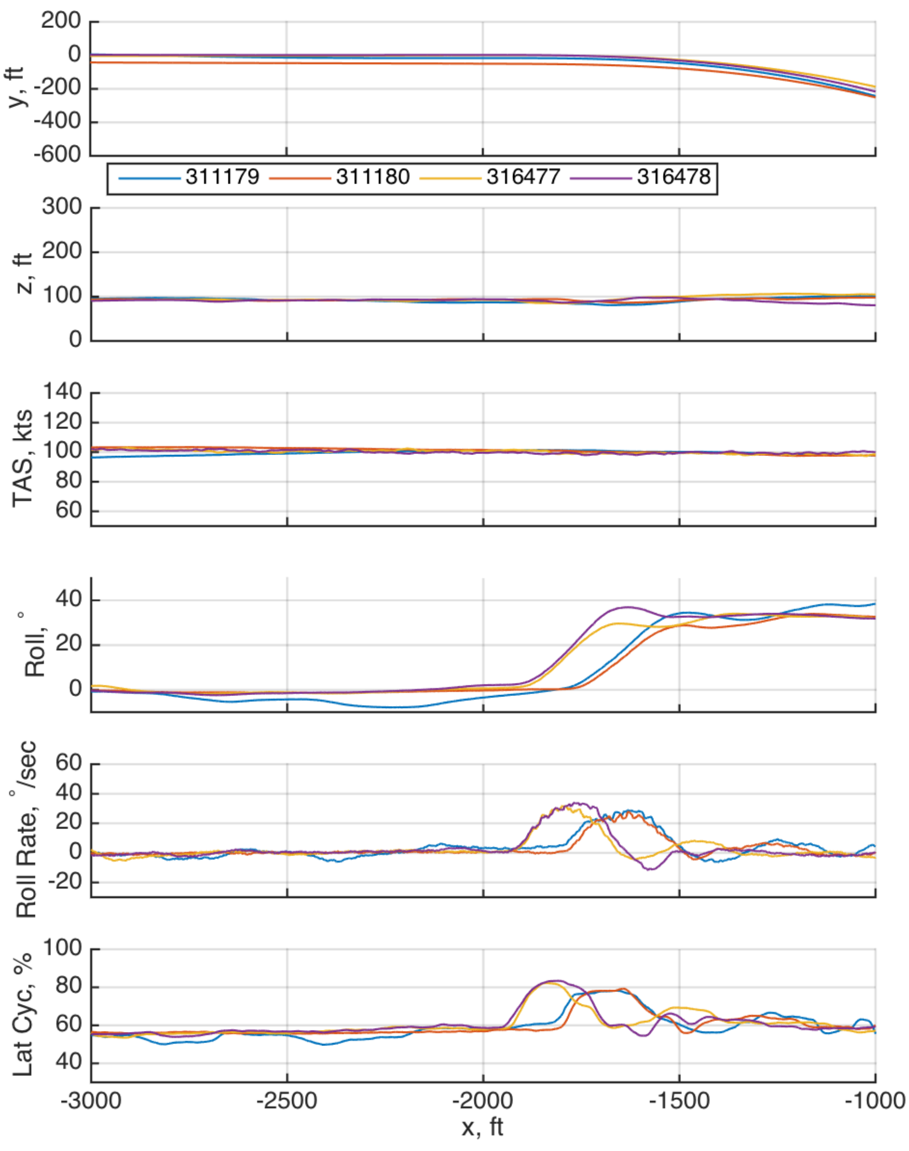


Figure 141: EH-60L M5 test condition, 95 knots, level 30° right bank.

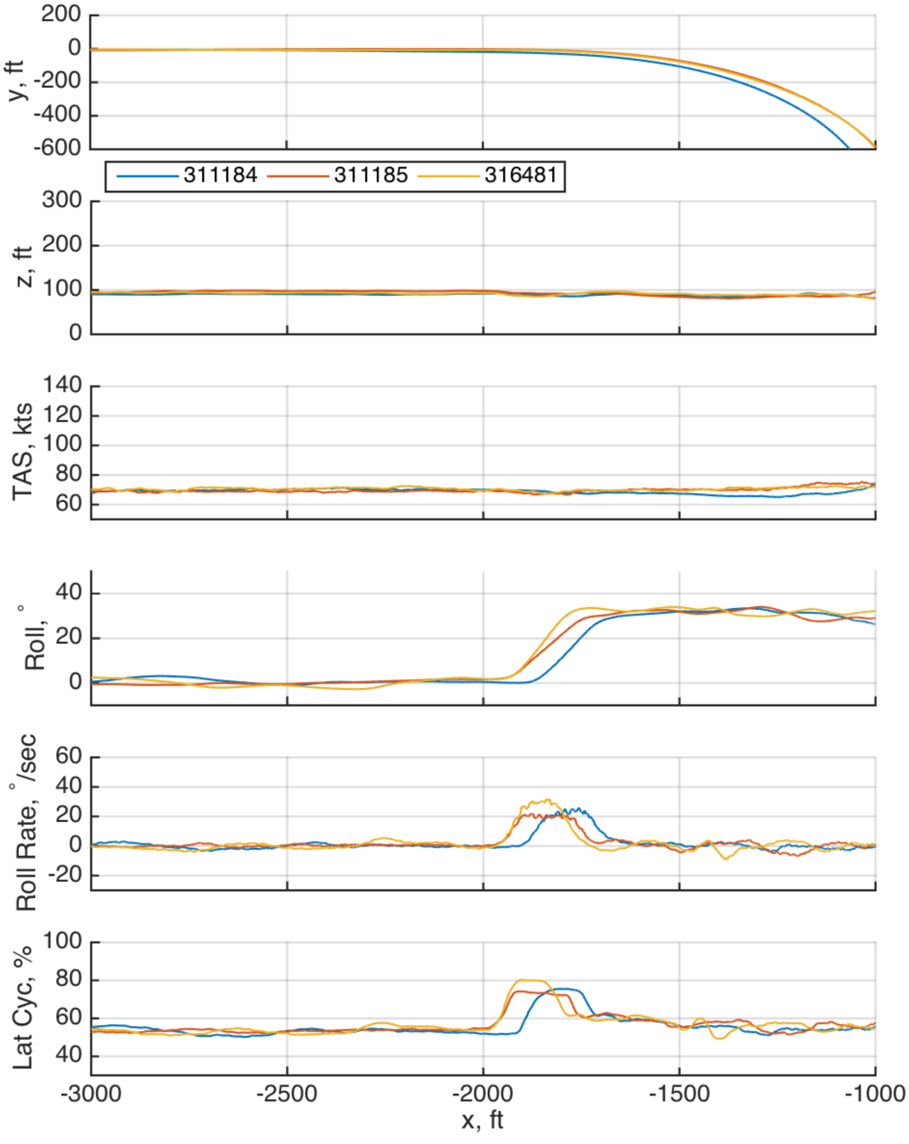


Figure 142: EH-60L M6 test condition, 65 knots, level 30° right bank.

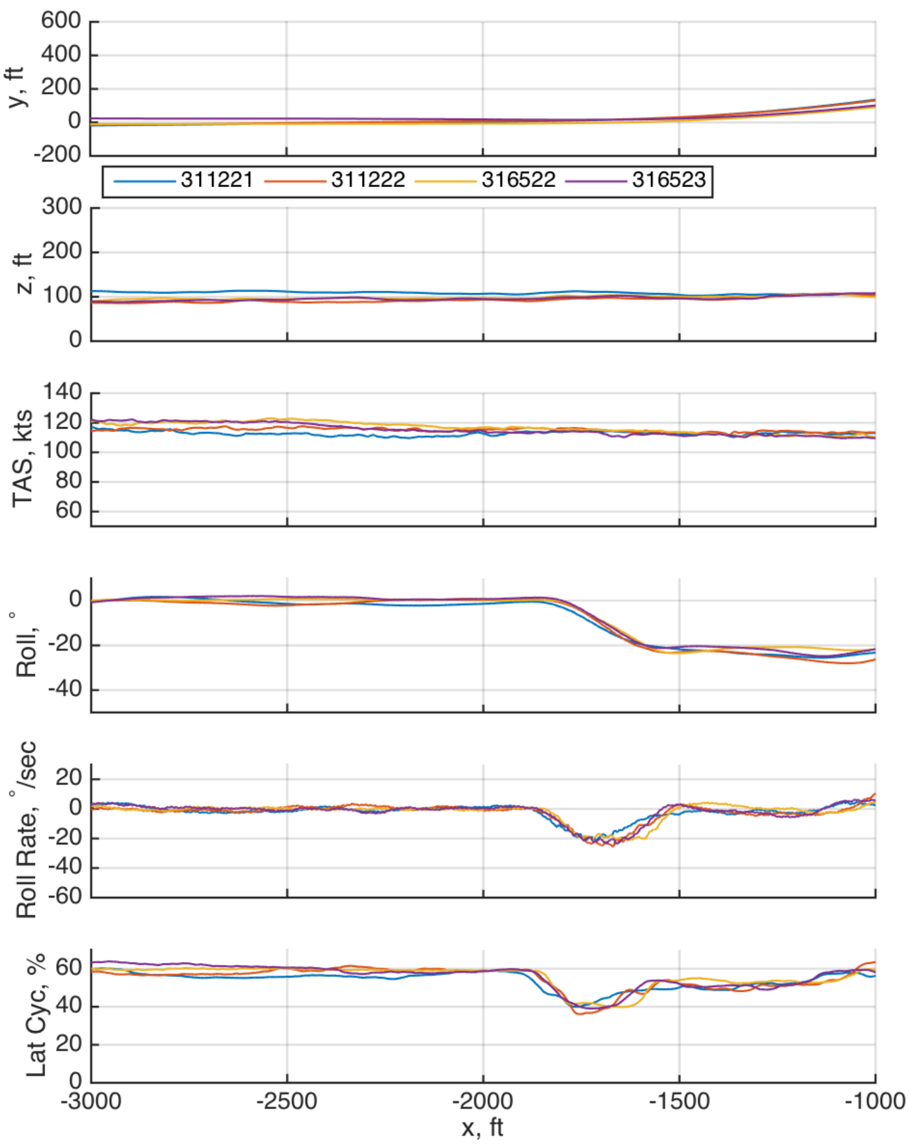


Figure 143: EH-60L M7 test condition, 110 knots, level 20° left bank.

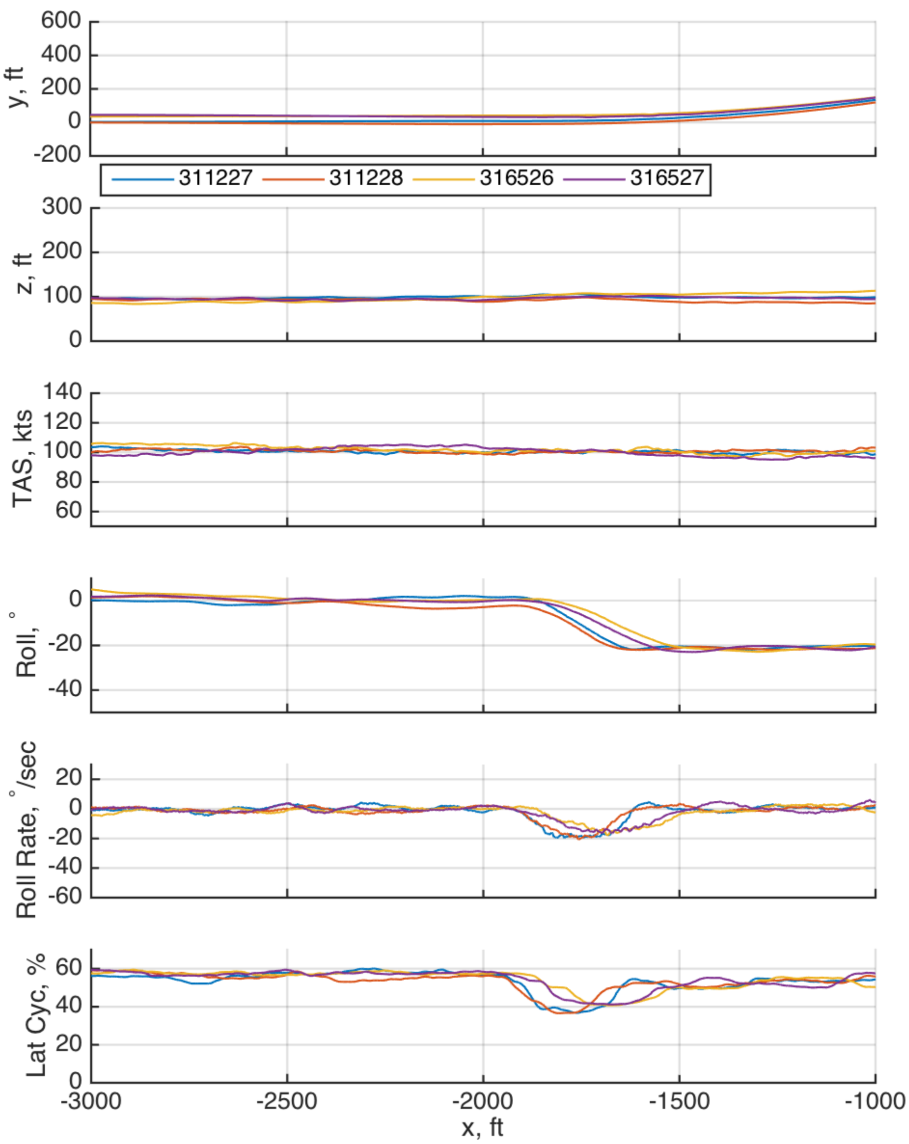


Figure 144: EH-60L M8 test condition, 95 knots, level 20° left bank.

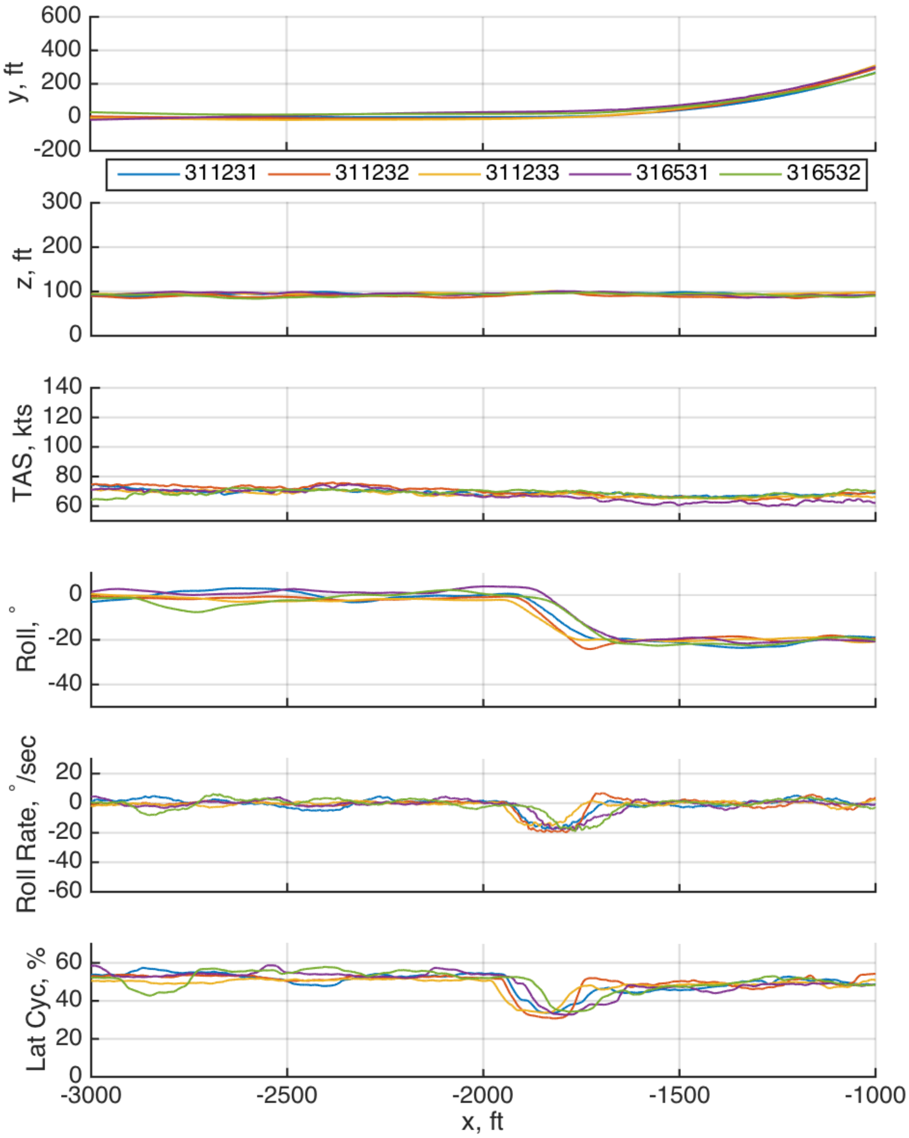


Figure 145: EH-60L M9 test condition, 65 knots, level 20° left bank.

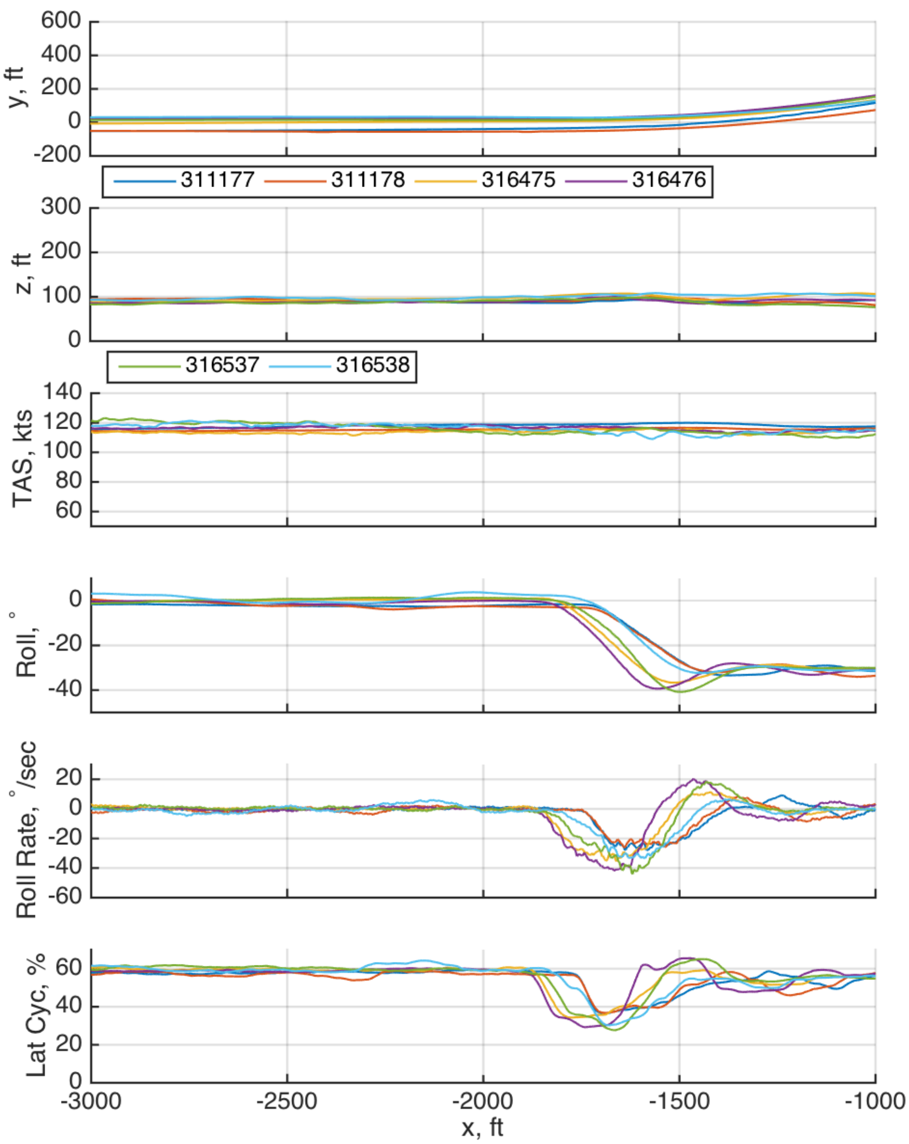


Figure 146: EH-60L M10 test condition, 110 knots, level 30° left bank.

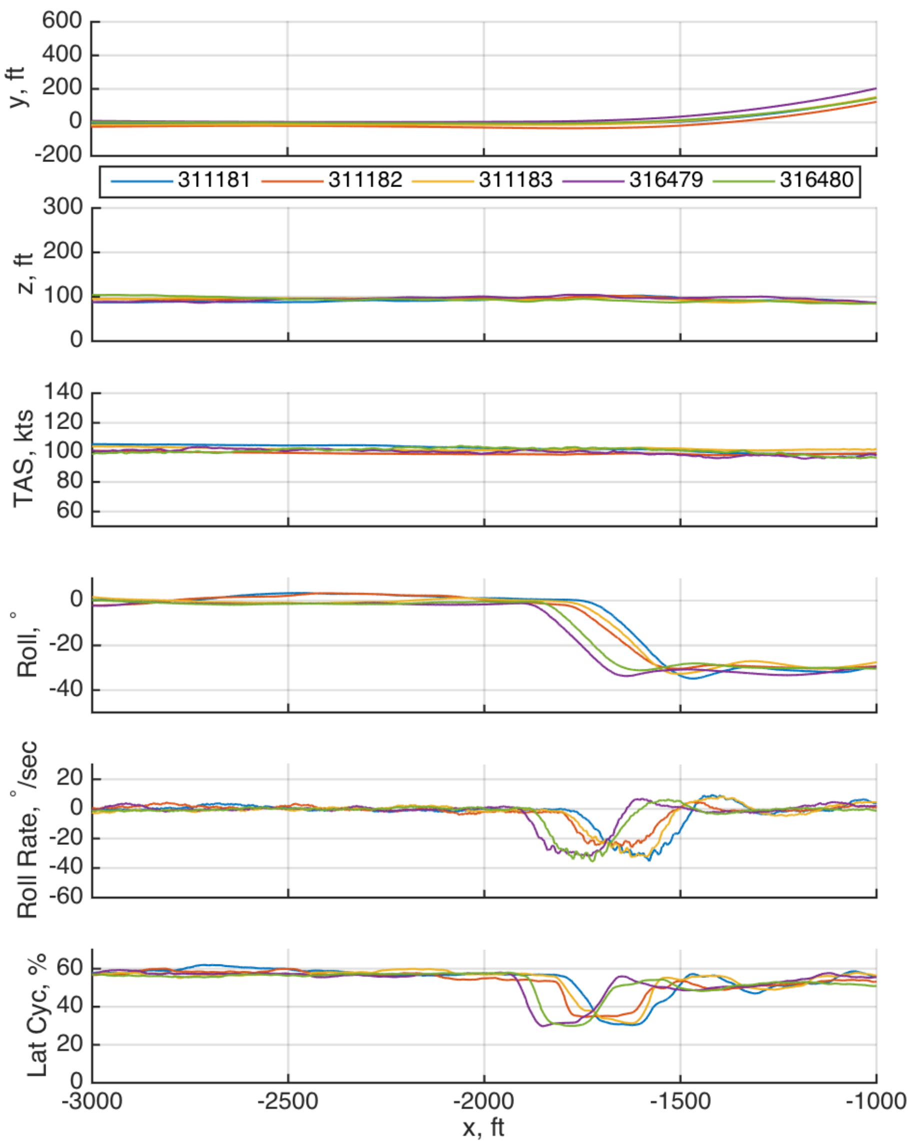


Figure 147: EH-60L M11 test condition, 95 knots, level 30° left bank.

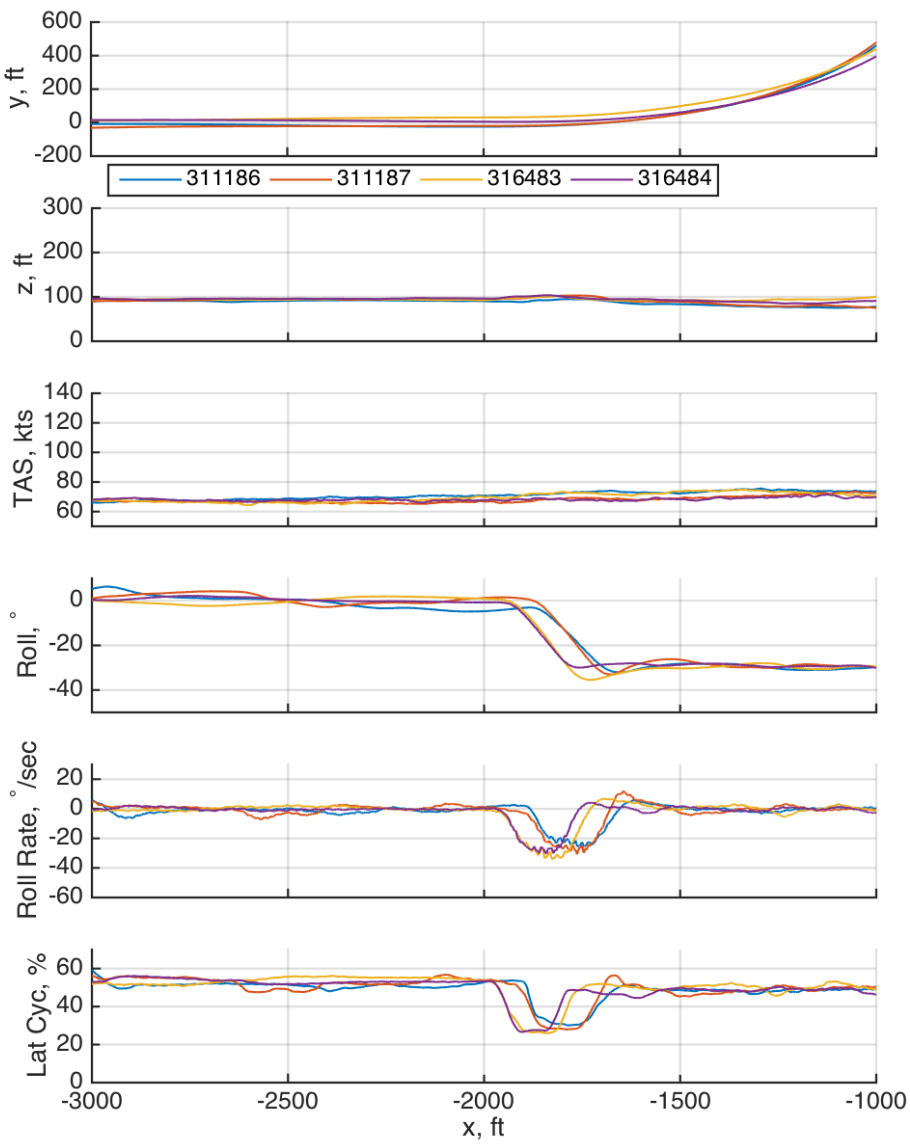


Figure 148: EH-60L M12 test condition, 65 knots, level 30° left bank.

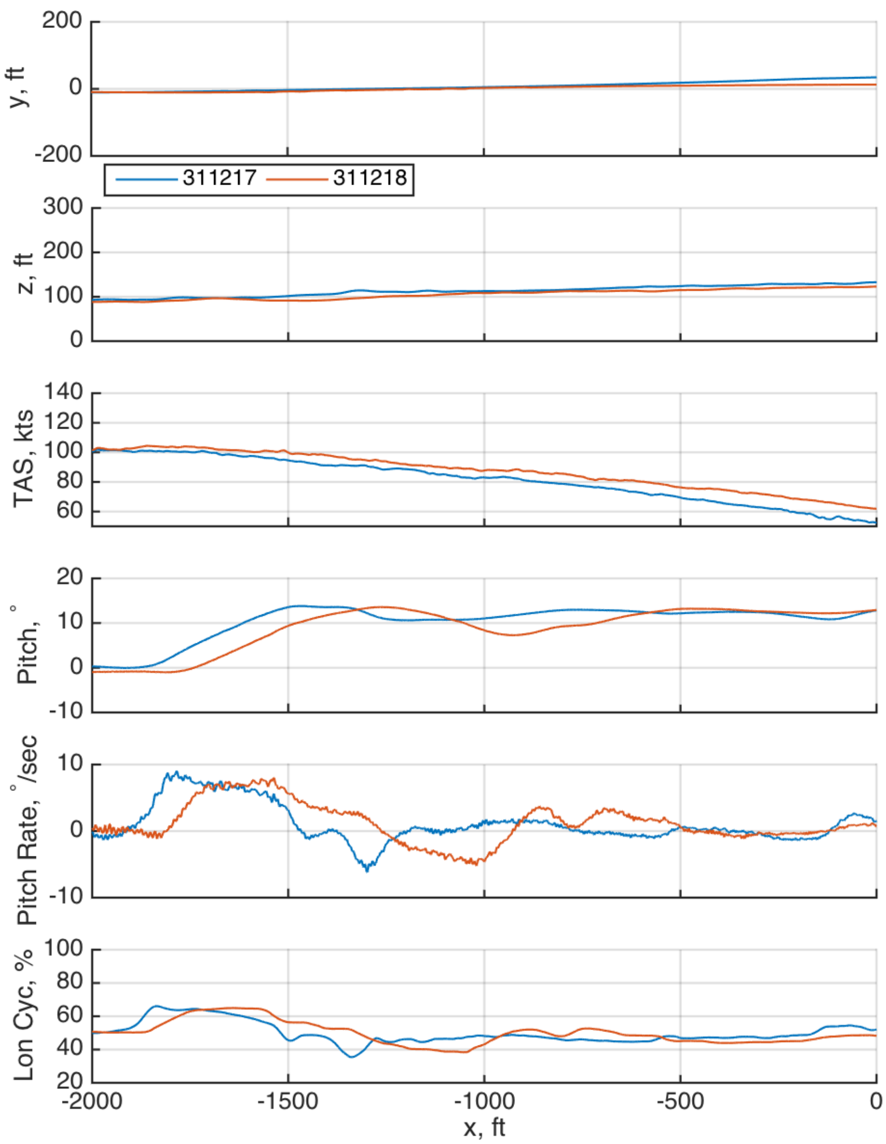


Figure 149: EH-60L M13 test condition, 95 knots, moderate quick stop.

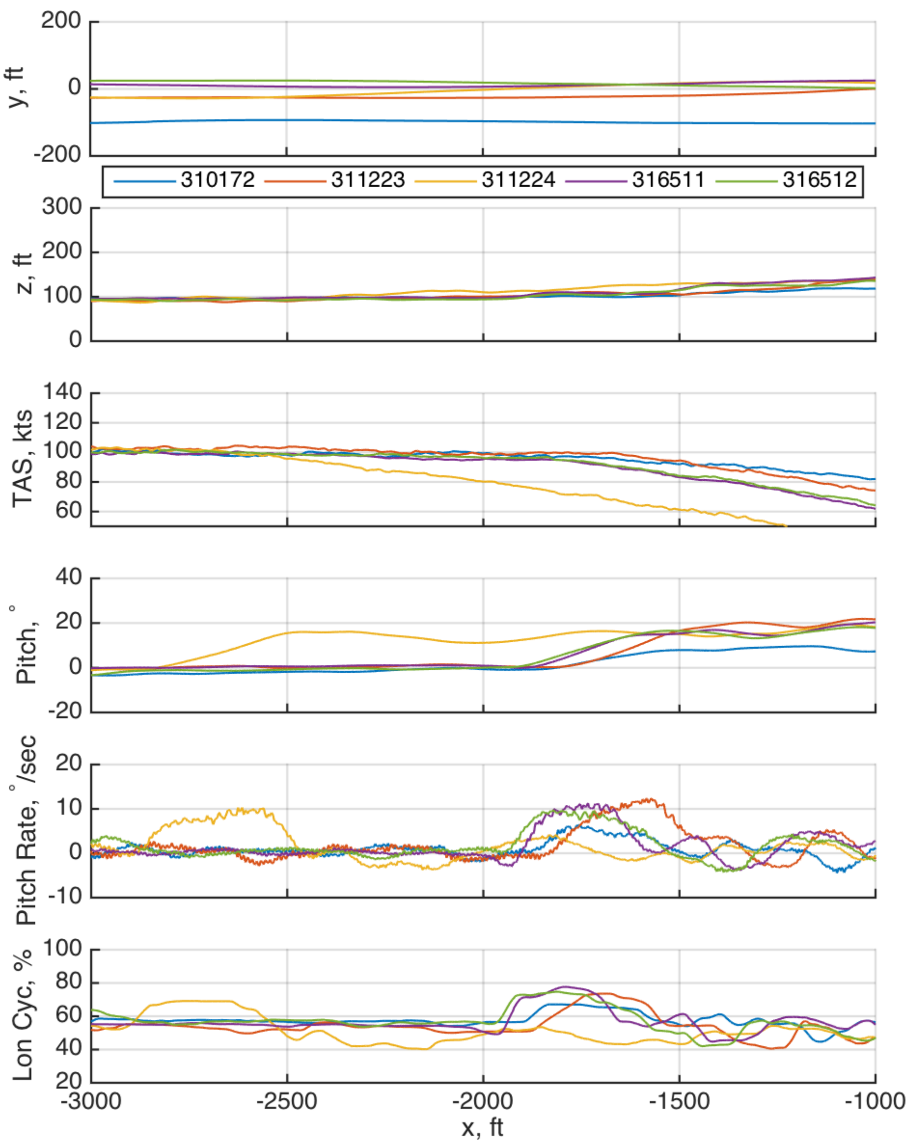


Figure 150: EH-60L M14 test condition, 95 knots, aggressive quick stop.

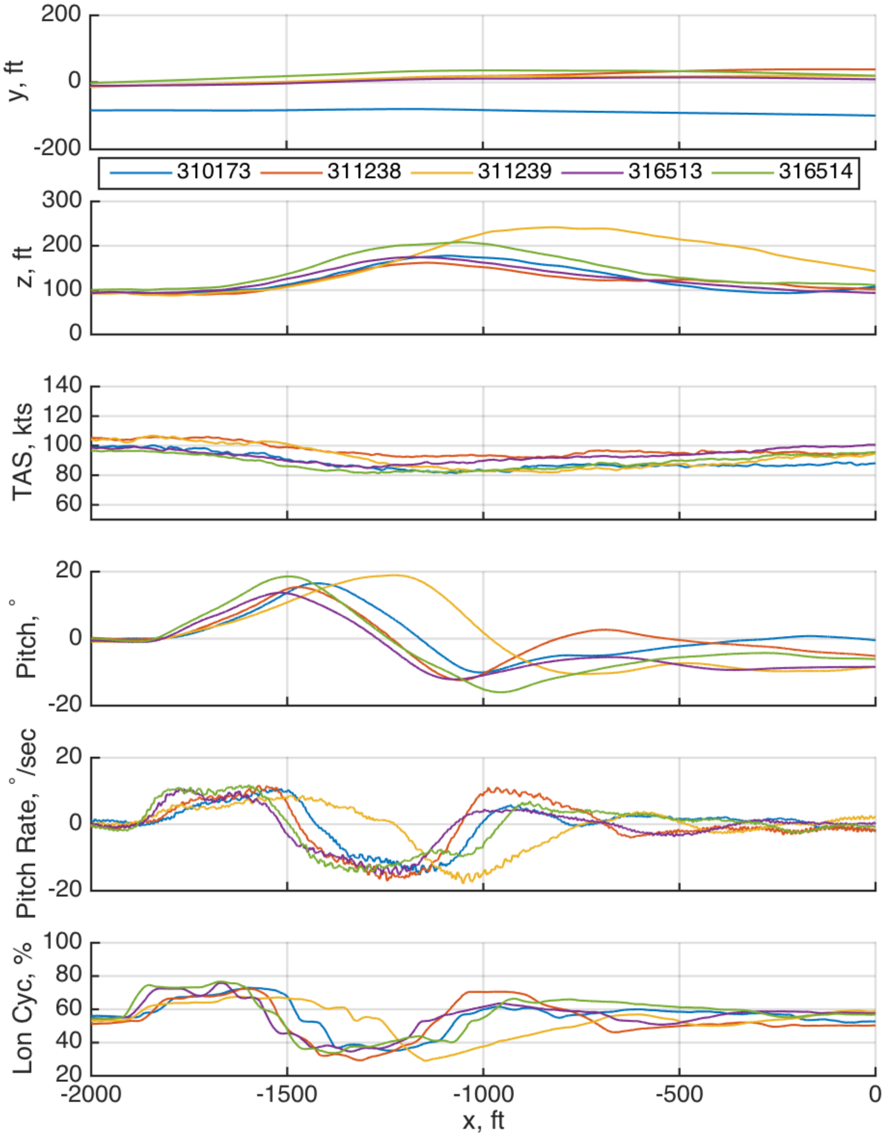


Figure 151: EH-60L M15 test condition, 95 knots, pull up, push over.

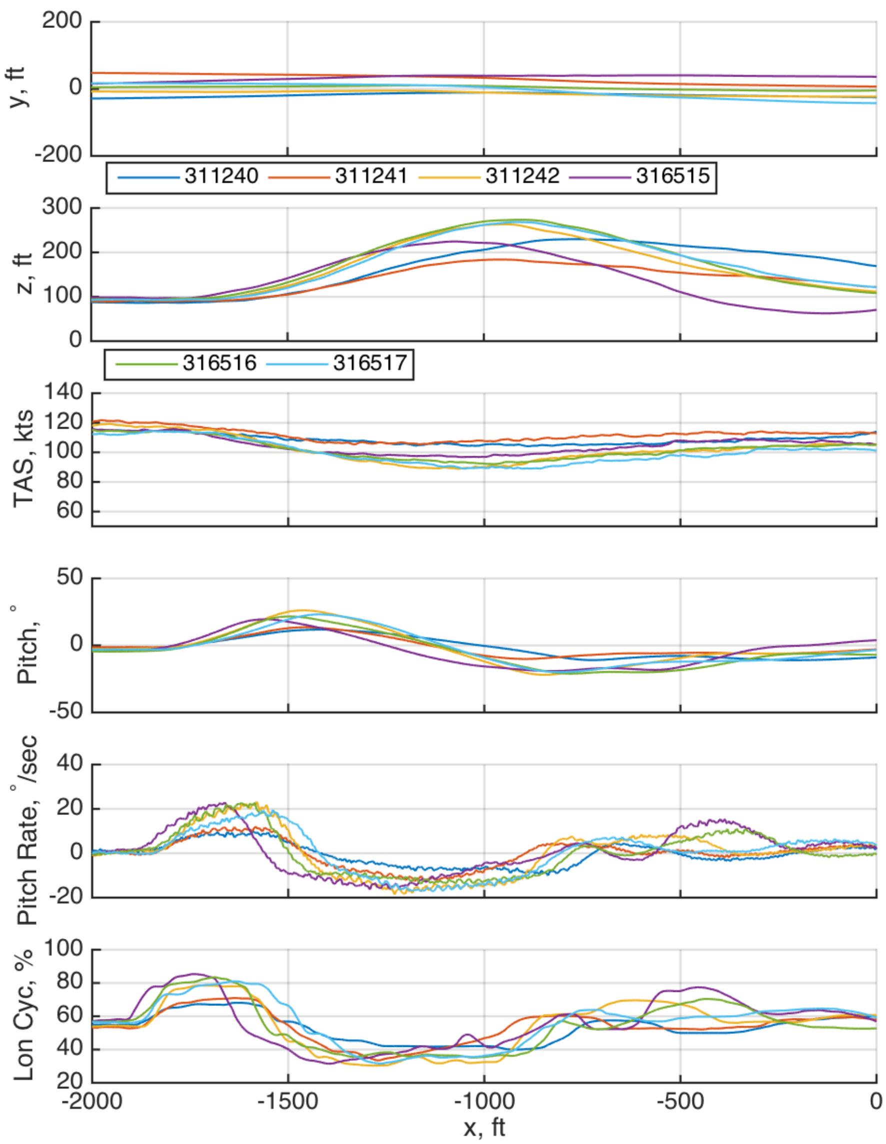


Figure 152: EH-60L M16 test condition, 110 knots, pull up, push over.

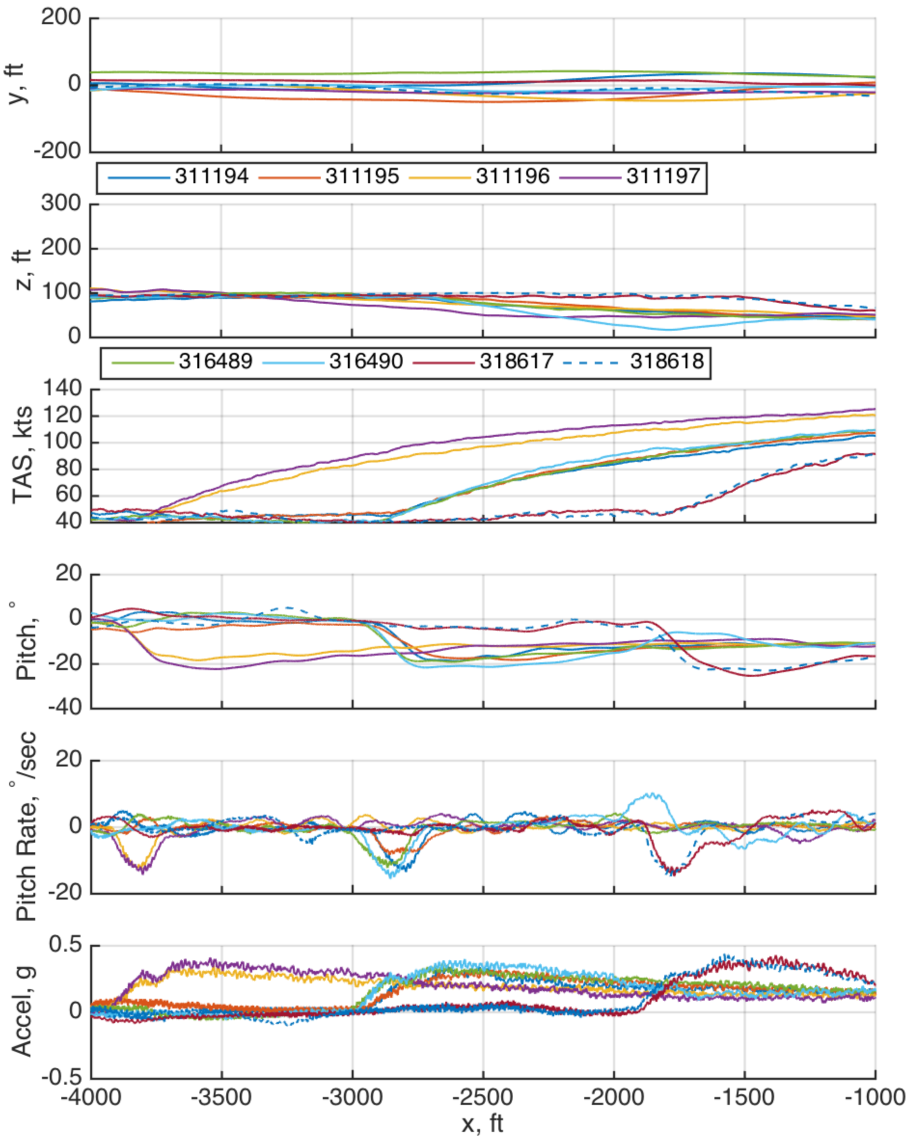


Figure 153: EH-60L M17 test condition, 40-140 knots, max level acceleration.

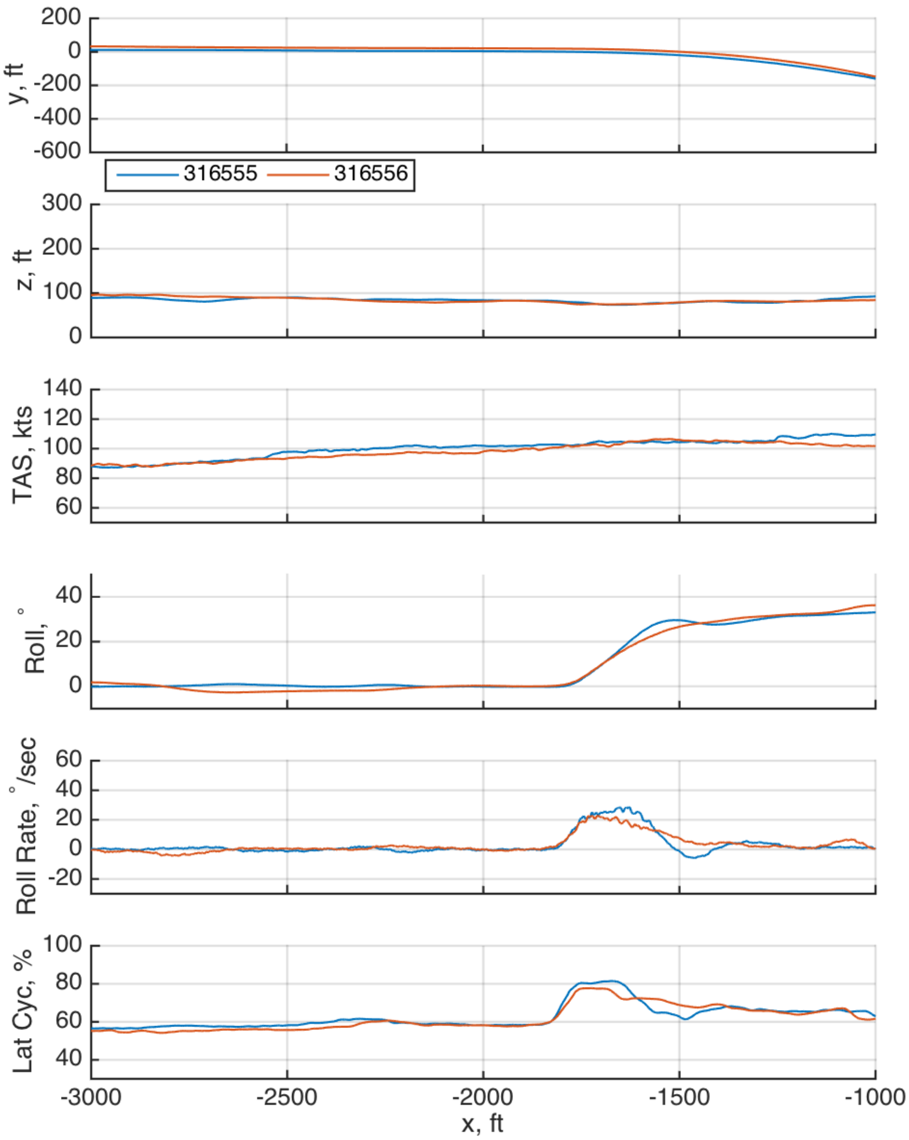


Figure 154: EH-60L M18 test condition, 80 knots, level approach, establish moderate acceleration then 30° right bank.

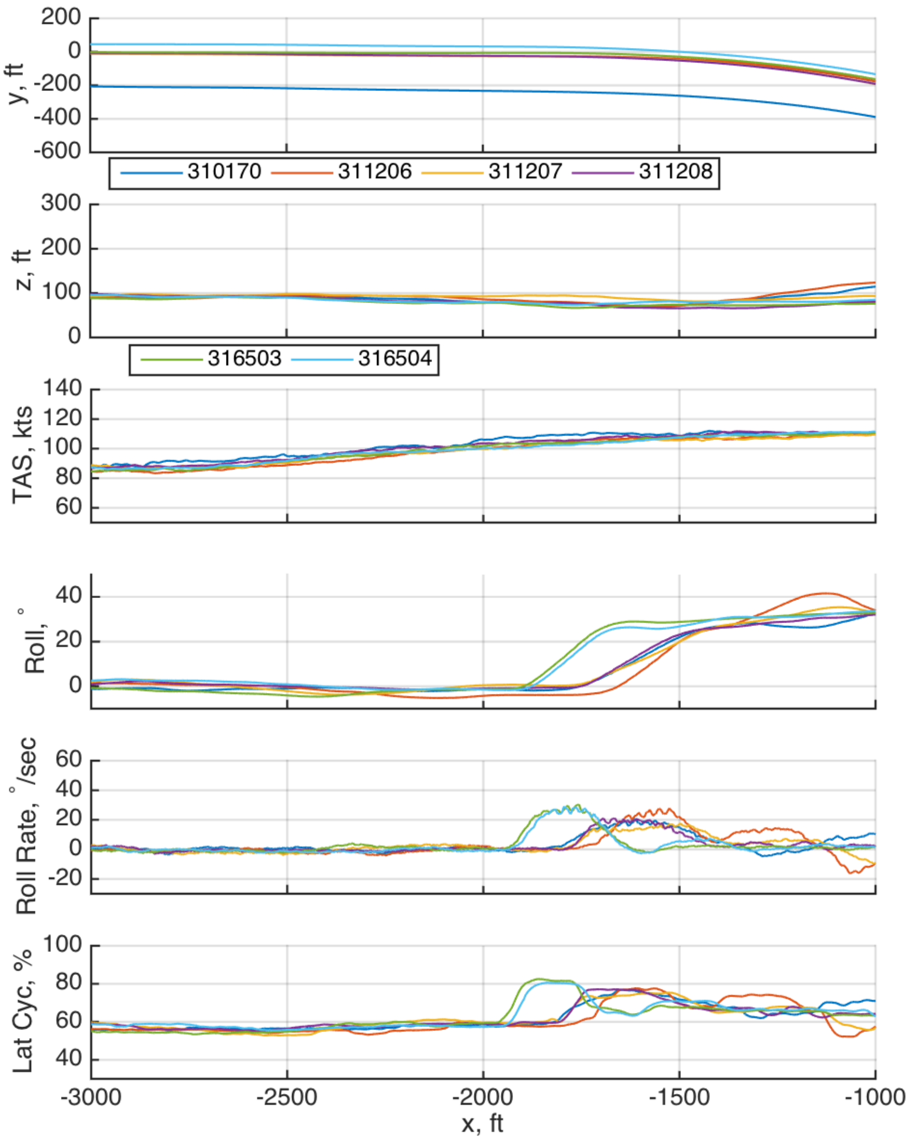


Figure 155: EH-60L M19 test condition, 80 knots, level approach, establish maximum acceleration then 30° right bank.

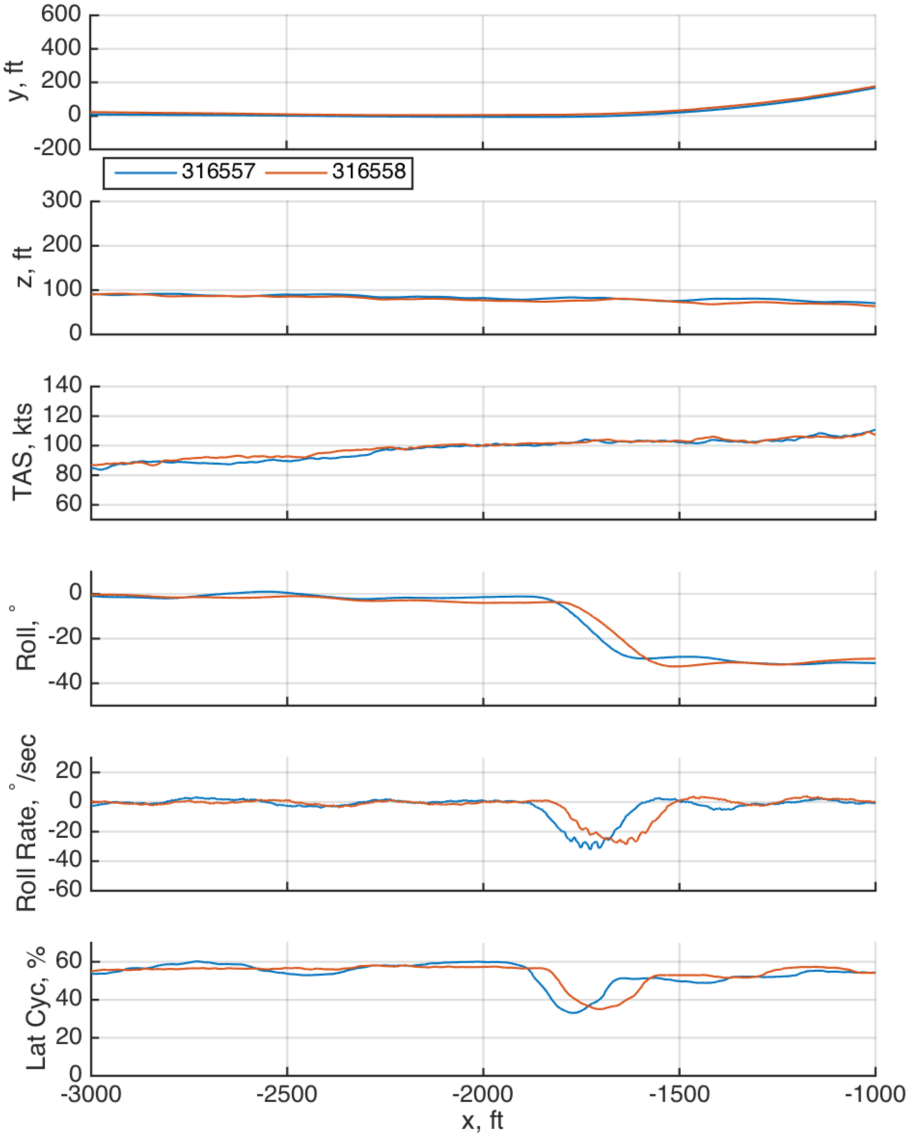


Figure 156: EH-60L M20 test condition, 80 knots, level approach, establish moderate acceleration then 30° left bank.

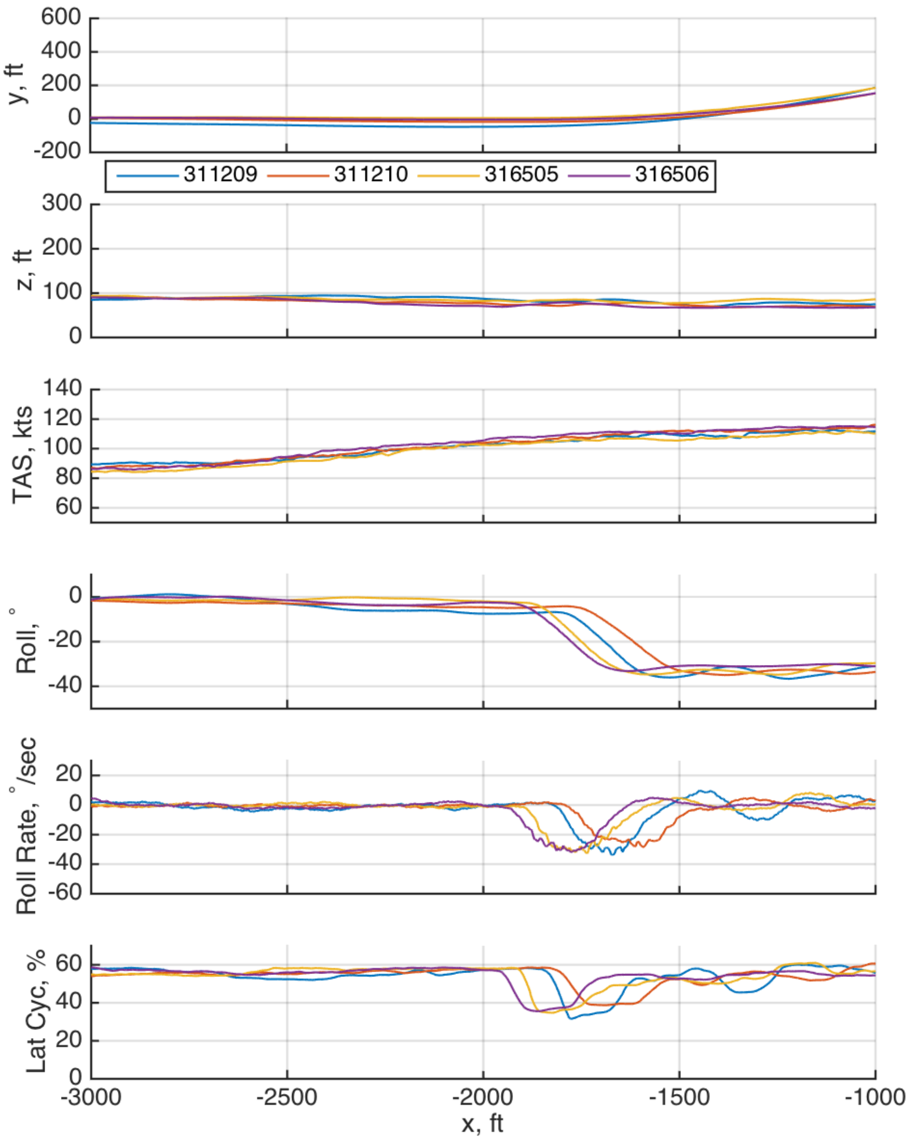


Figure 157: EH-60L M21 test condition, 80 knots, level approach, establish maximum acceleration then 30° left bank.

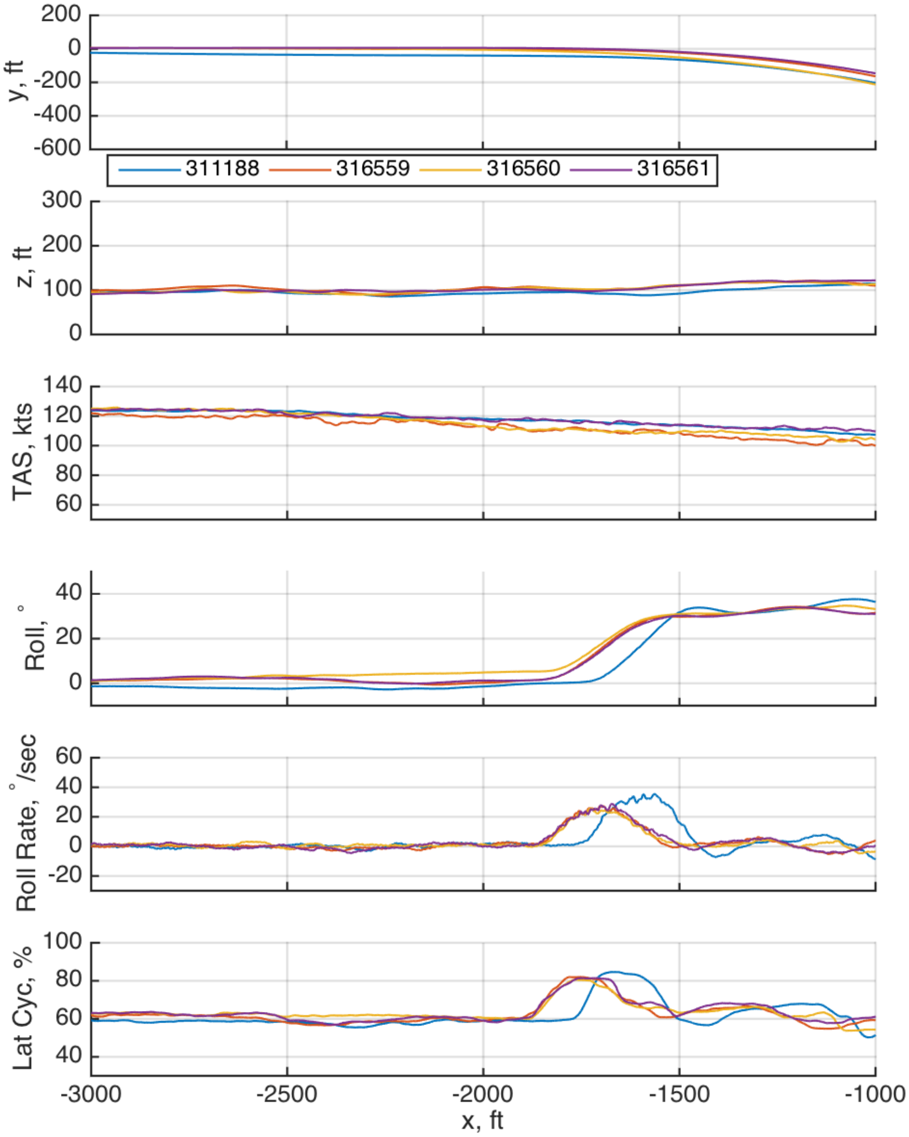


Figure 158: EH-60L M22 test condition, 120 knots, level approach, establish moderate deceleration then 30° right bank.

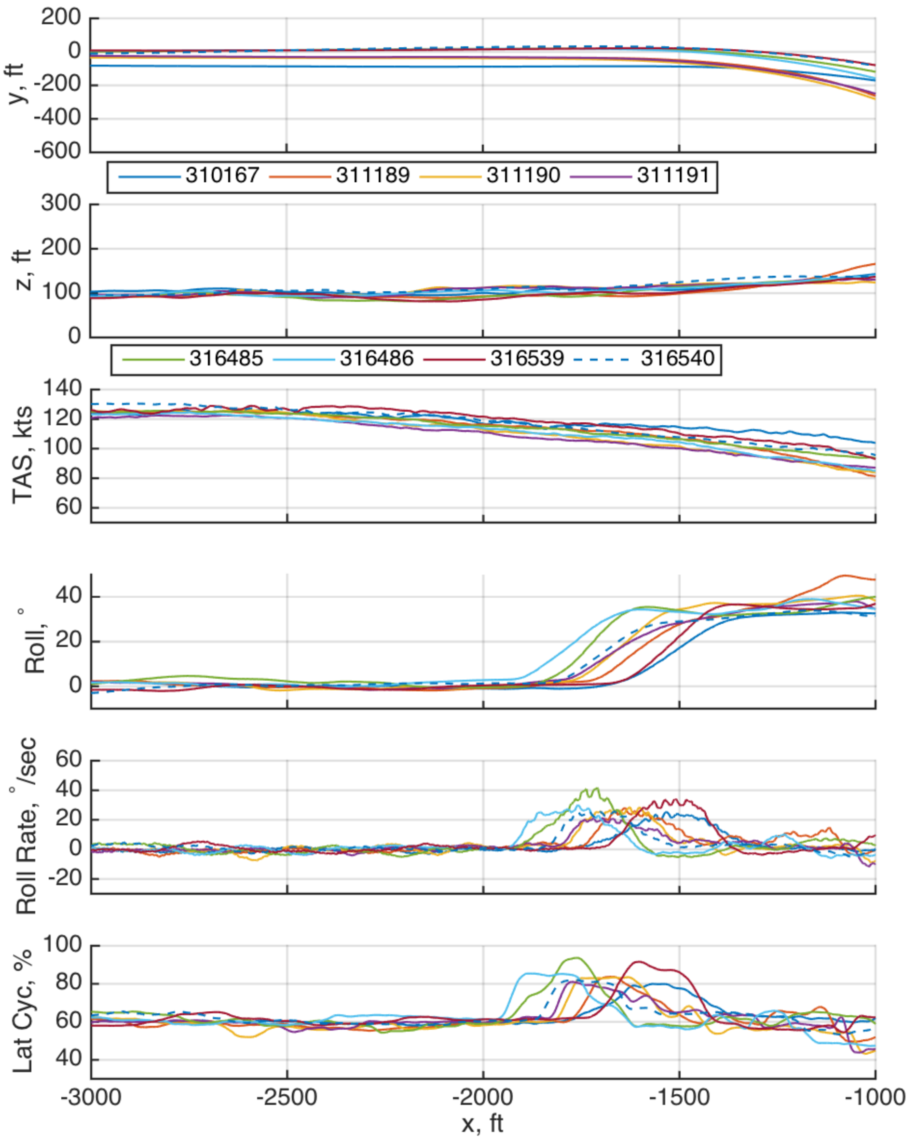


Figure 159: EH-60L M23 test condition, 120 knots, level approach, establish maximum deceleration then 30° right bank.

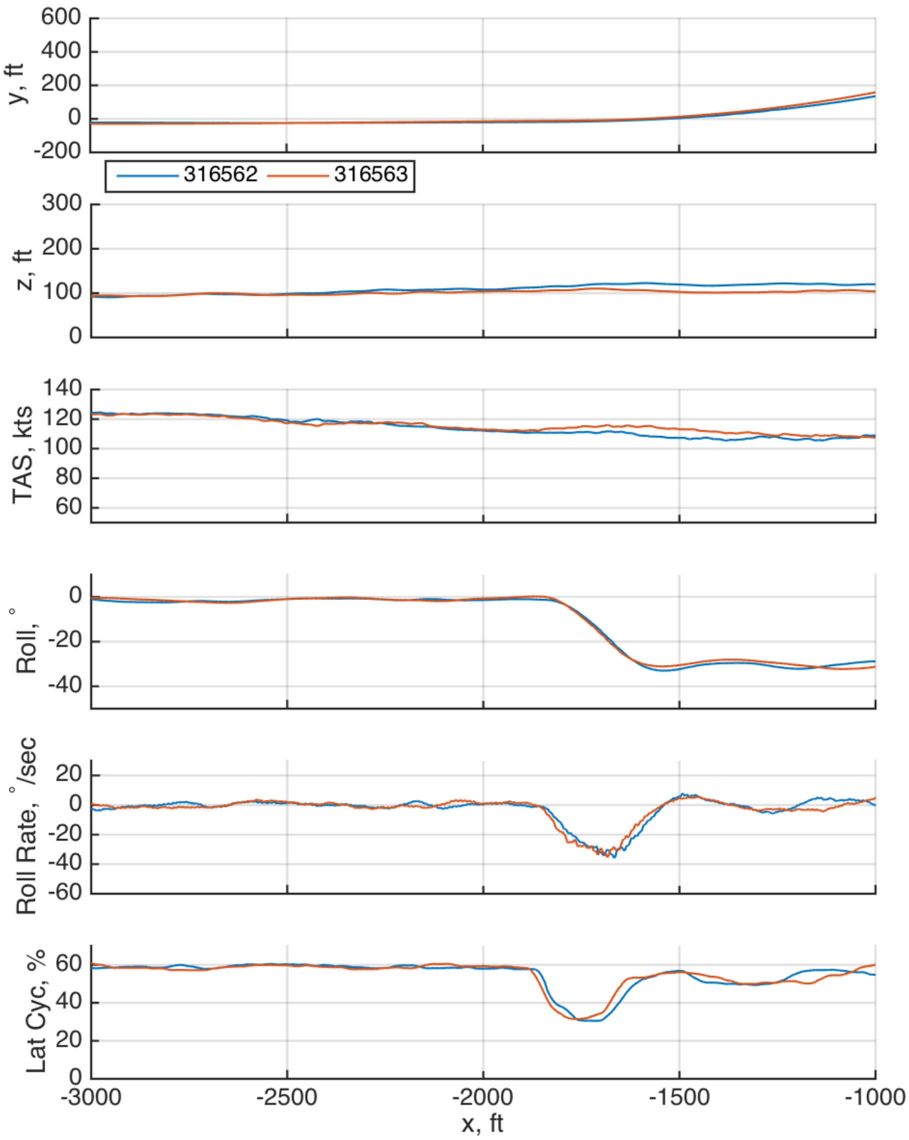


Figure 160: EH-60L M24 test condition, 120 knots, level approach, establish moderate deceleration then 30° left bank.

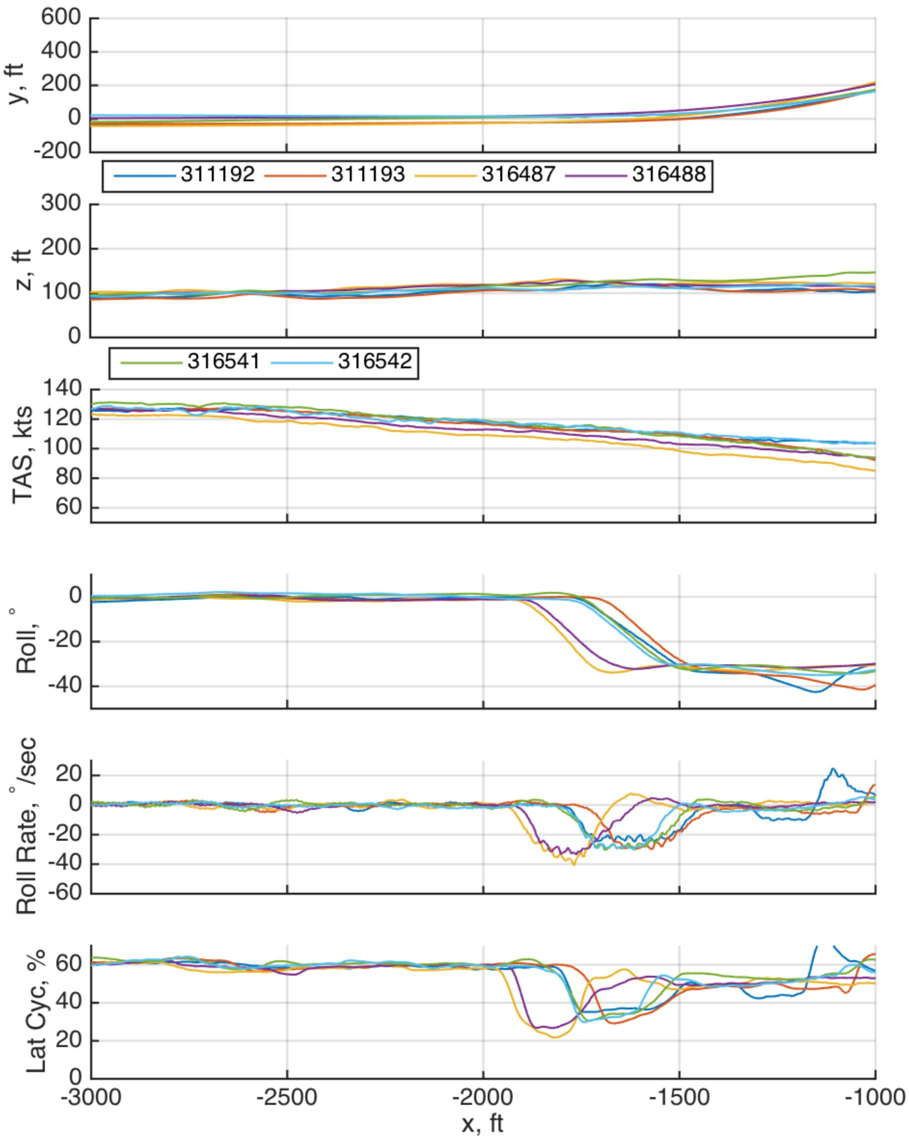


Figure 161: EH-60L M25 test condition, 120 knots, level approach, establish maximum deceleration then 30° left bank.

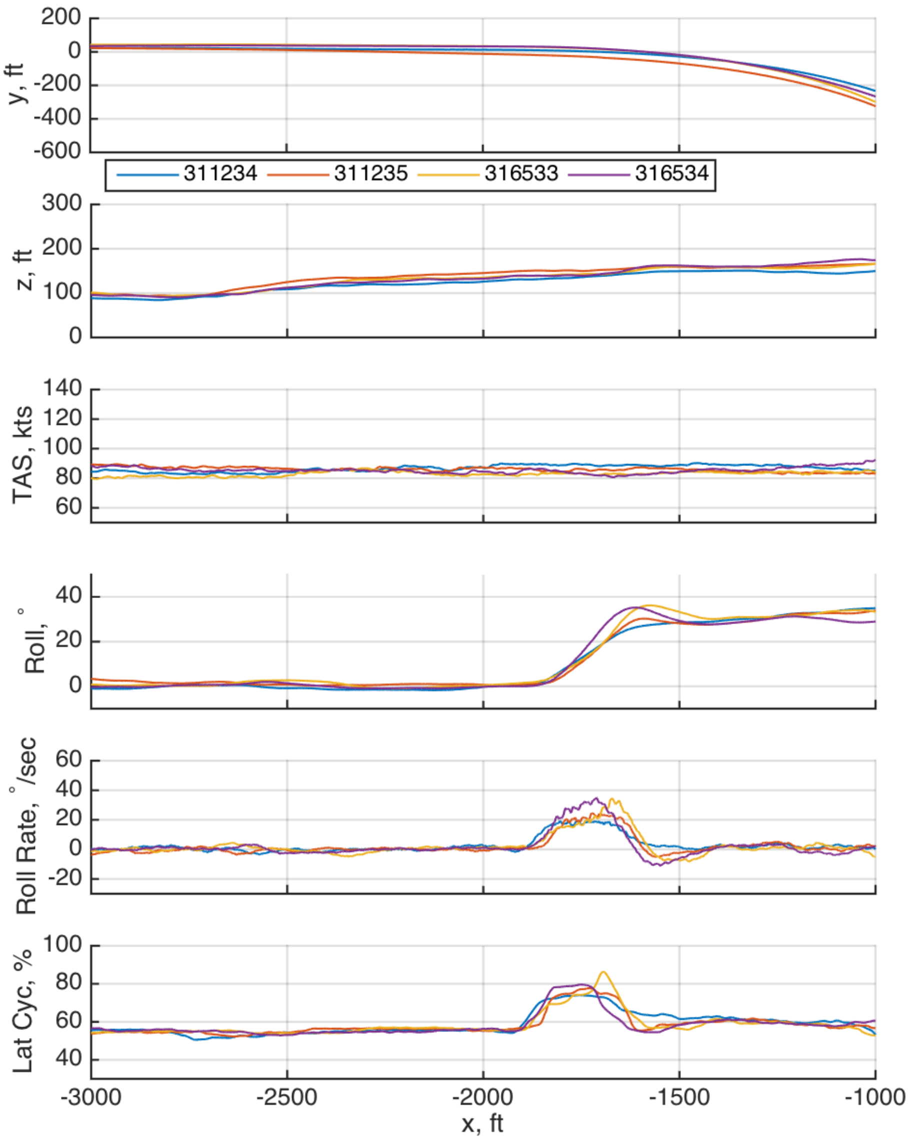


Figure 162: EH-60L M26 test condition, 80 knots, level approach, establish 3° climb then right bank.

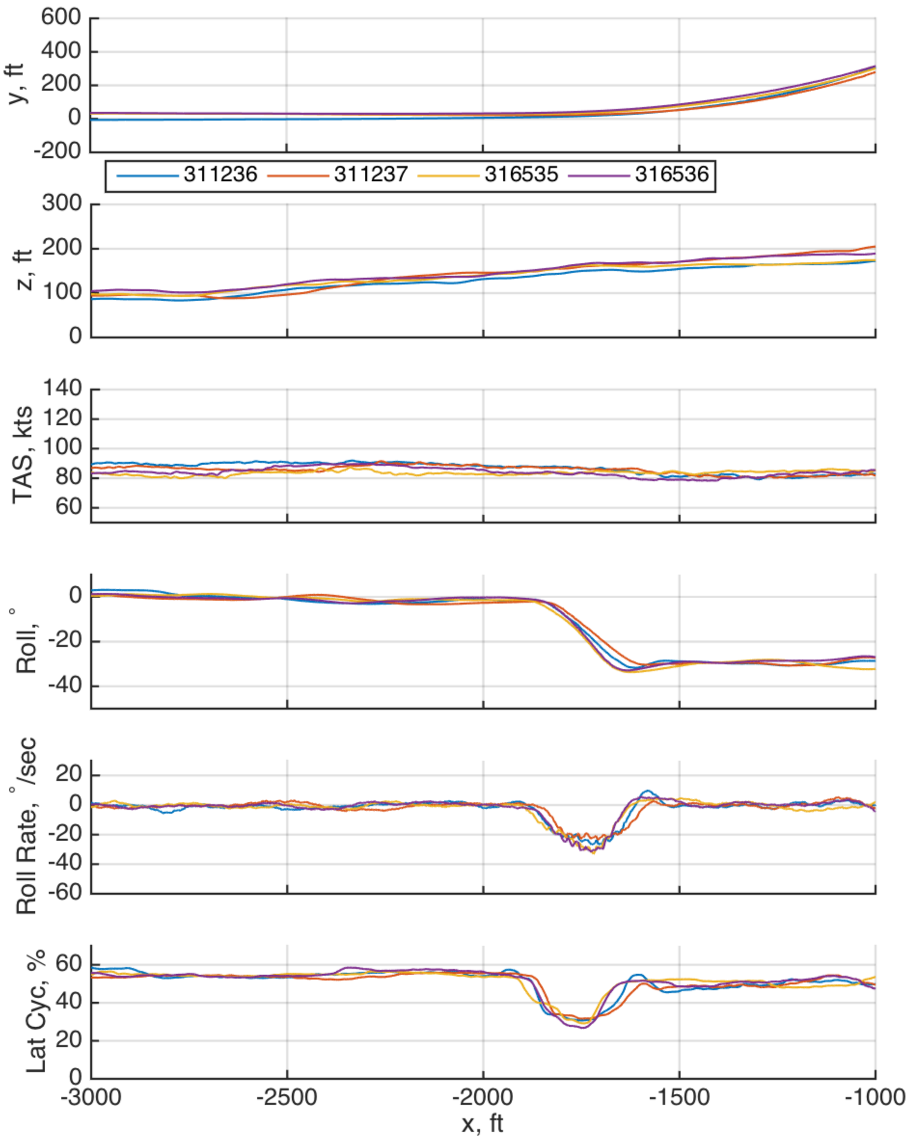


Figure 163: EH-60L M27 test condition, 80 knots, level approach, establish 3° climb then left bank.

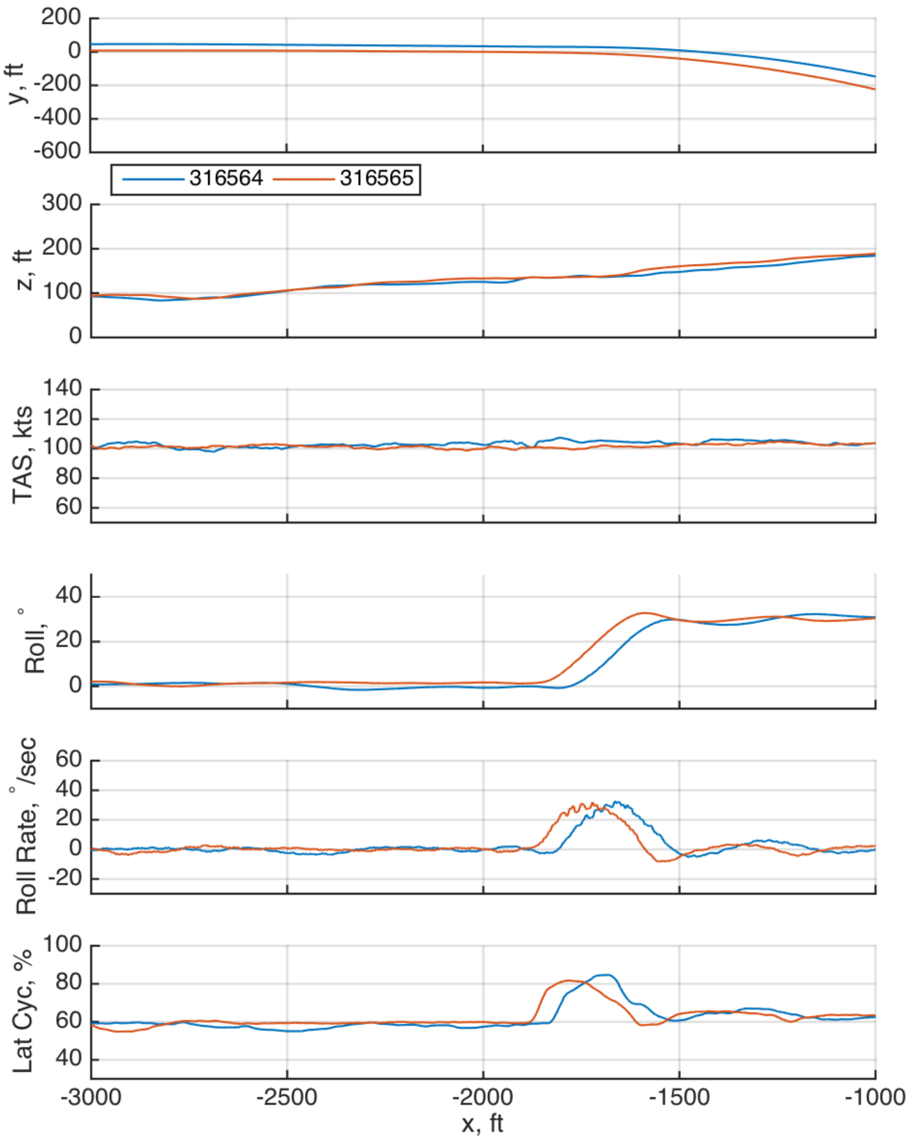


Figure 164: EH-60L M28 test condition, 95 knots, level approach, establish 3° climb then right bank.

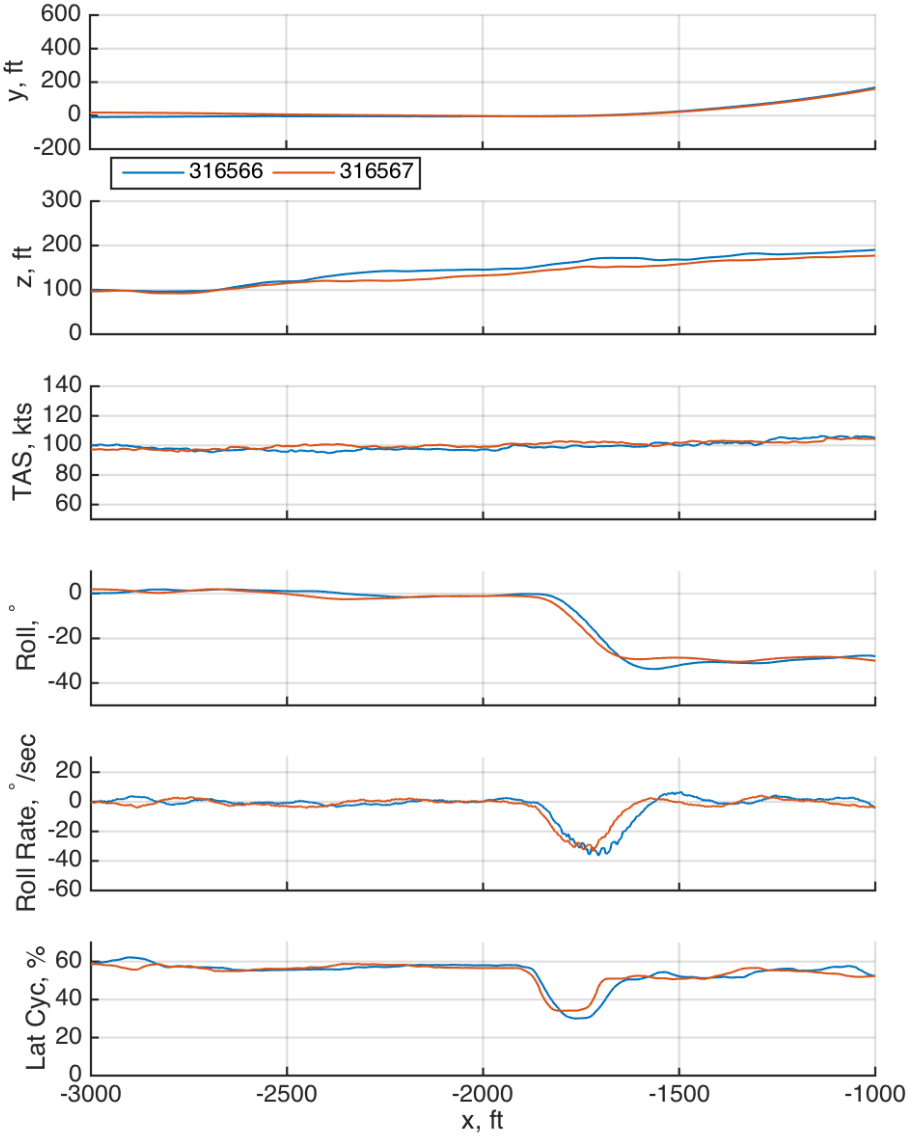


Figure 165: EH-60L M29 test condition, 95 knots, level approach, establish 3° climb then left bank.

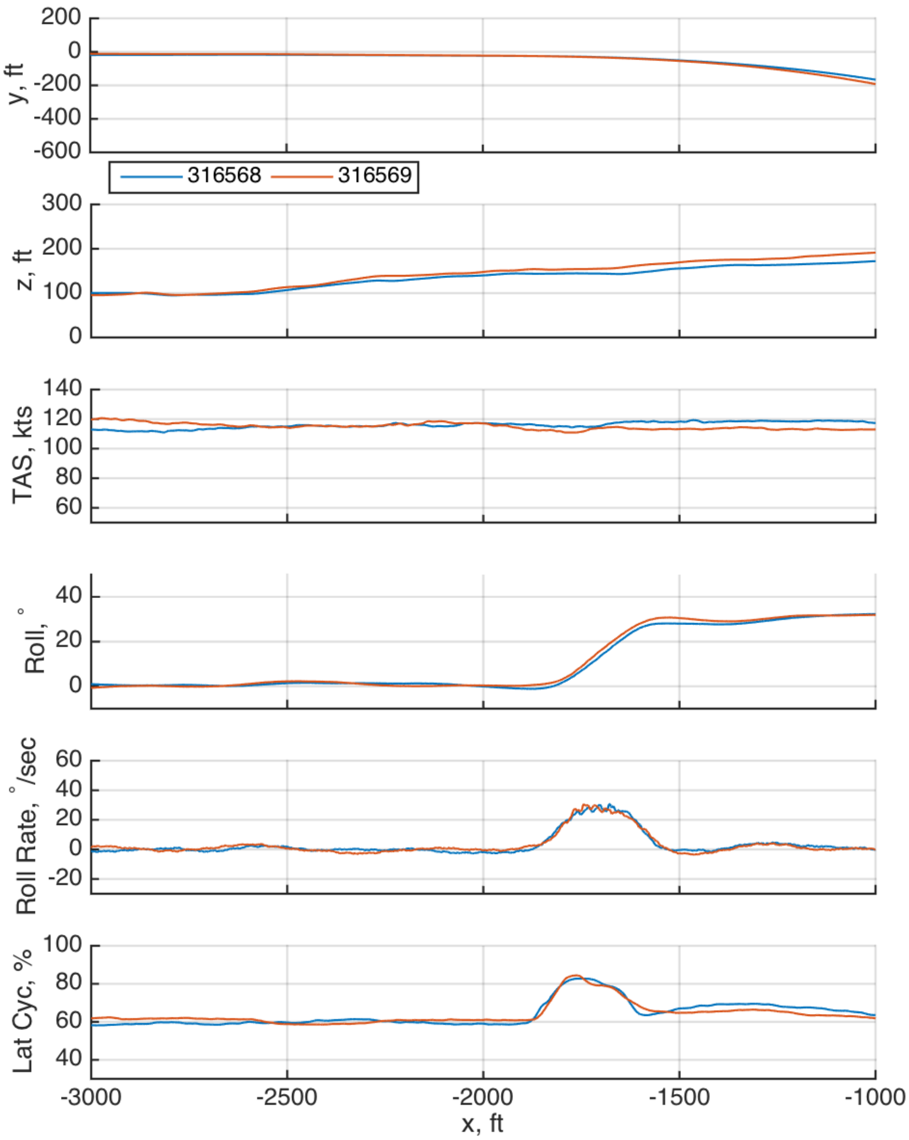


Figure 166: EH-60L M30 test condition, 110 knots, level approach, establish 3° climb then right bank.

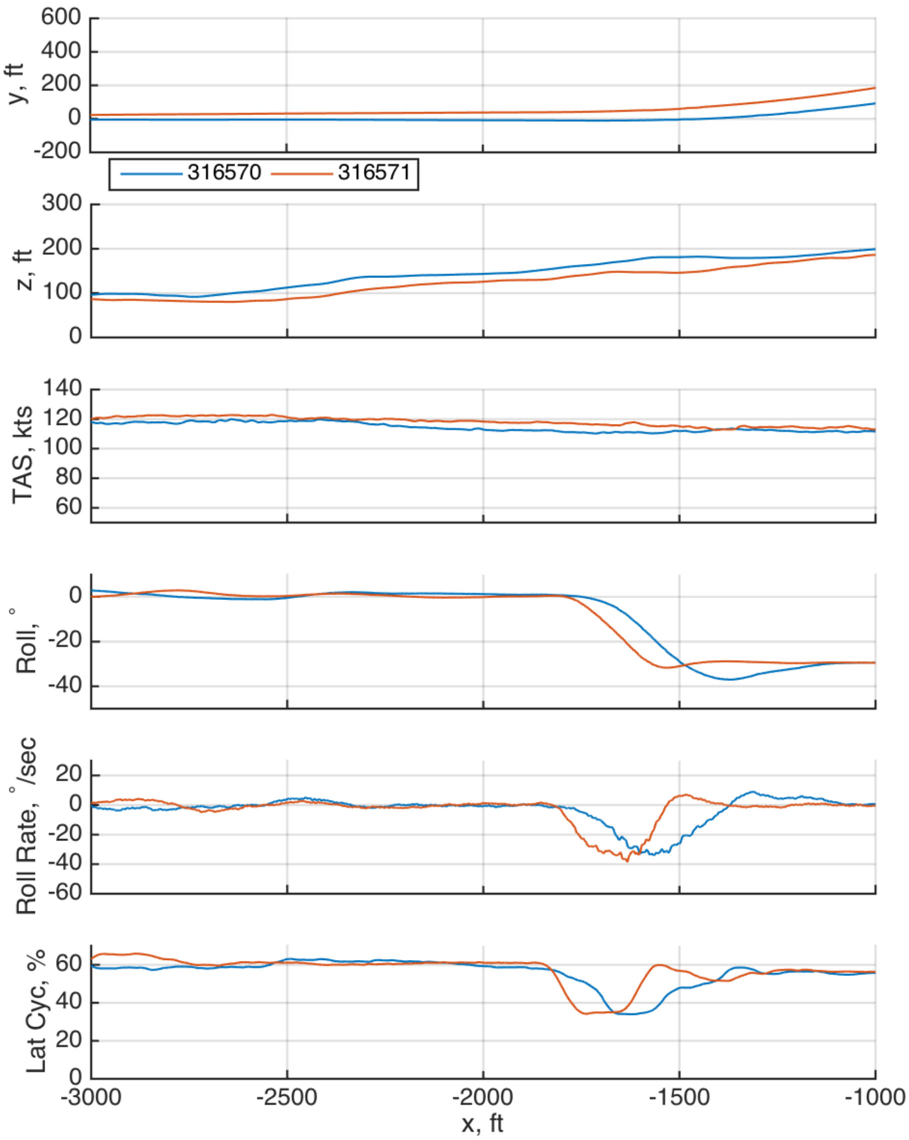


Figure 167: EH-60L M31 test condition, 110 knots, level approach, establish 3° climb then left bank.

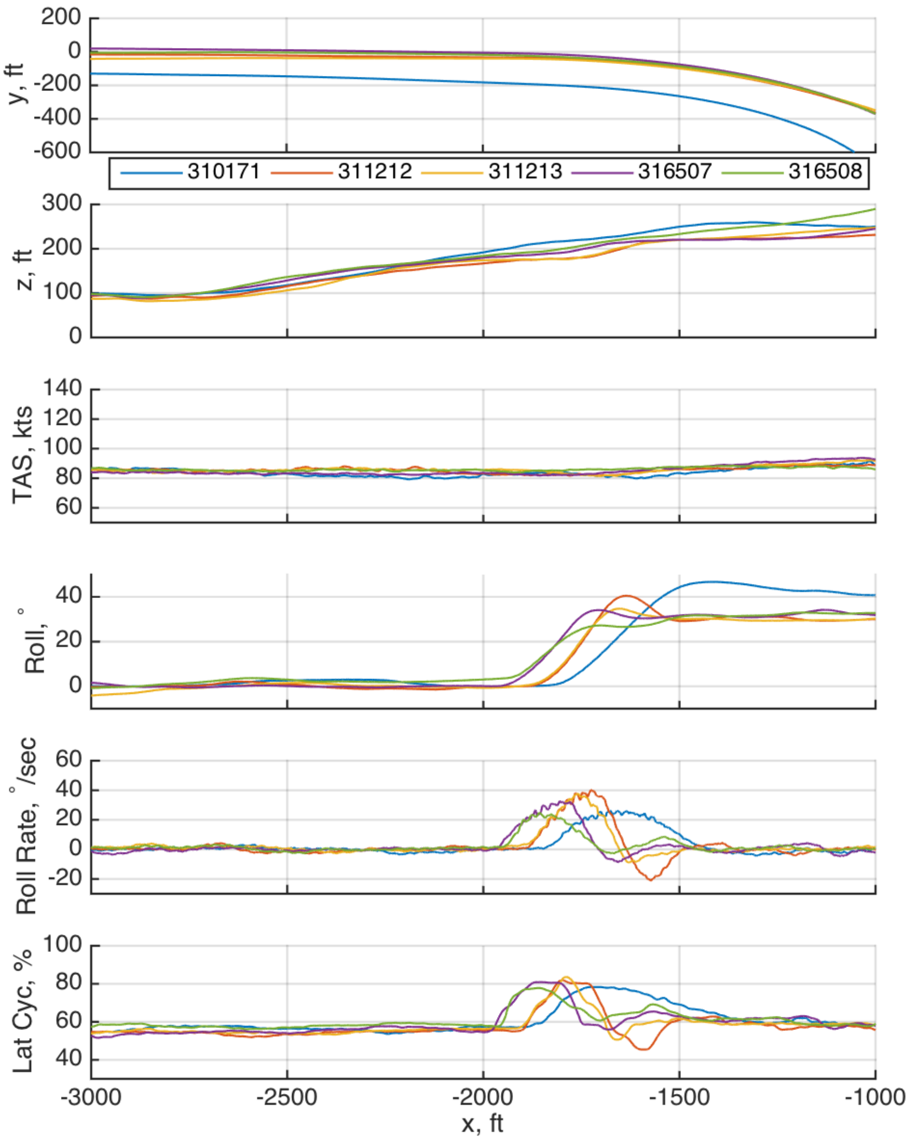


Figure 168: EH-60L M32 test condition, 80 knots, level approach, establish 6° climb then right bank.

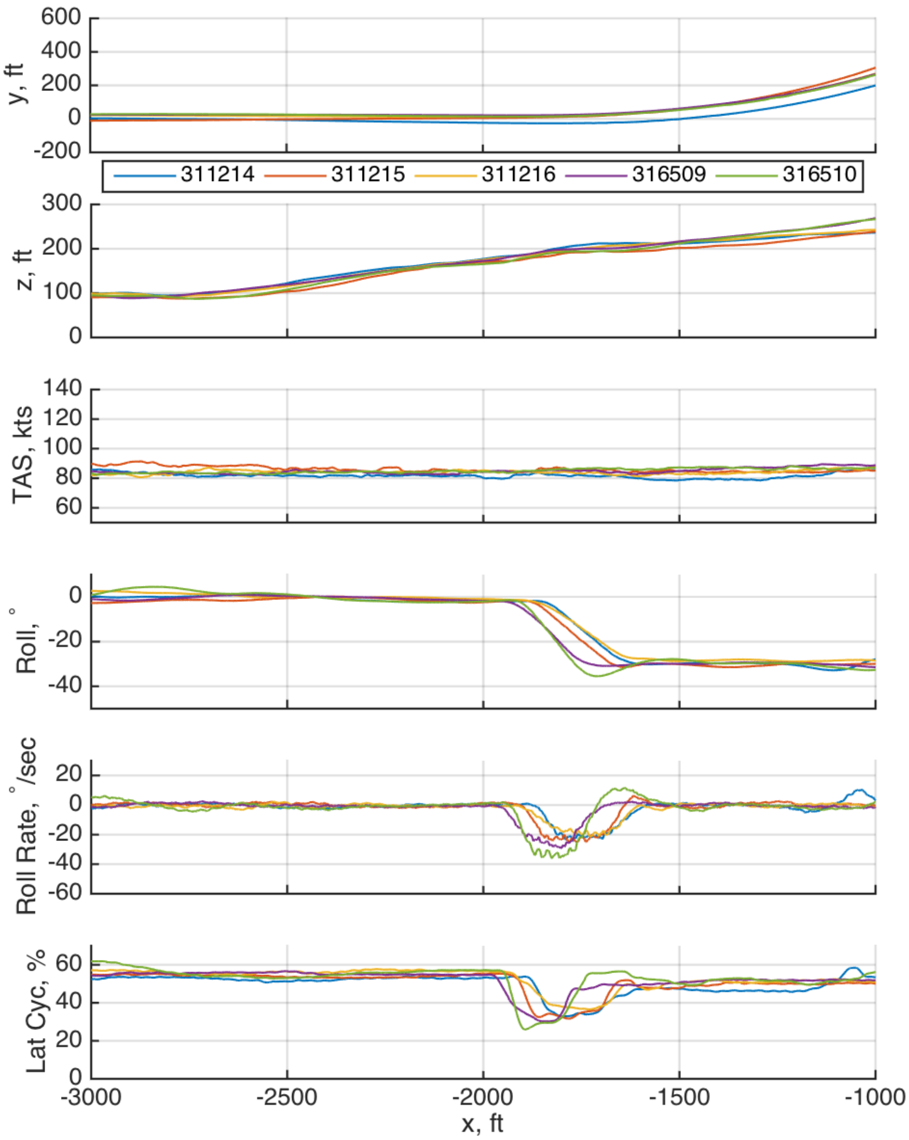


Figure 169: EH-60L M33 test condition, 80 knots, level approach, establish 6° climb then left bank.

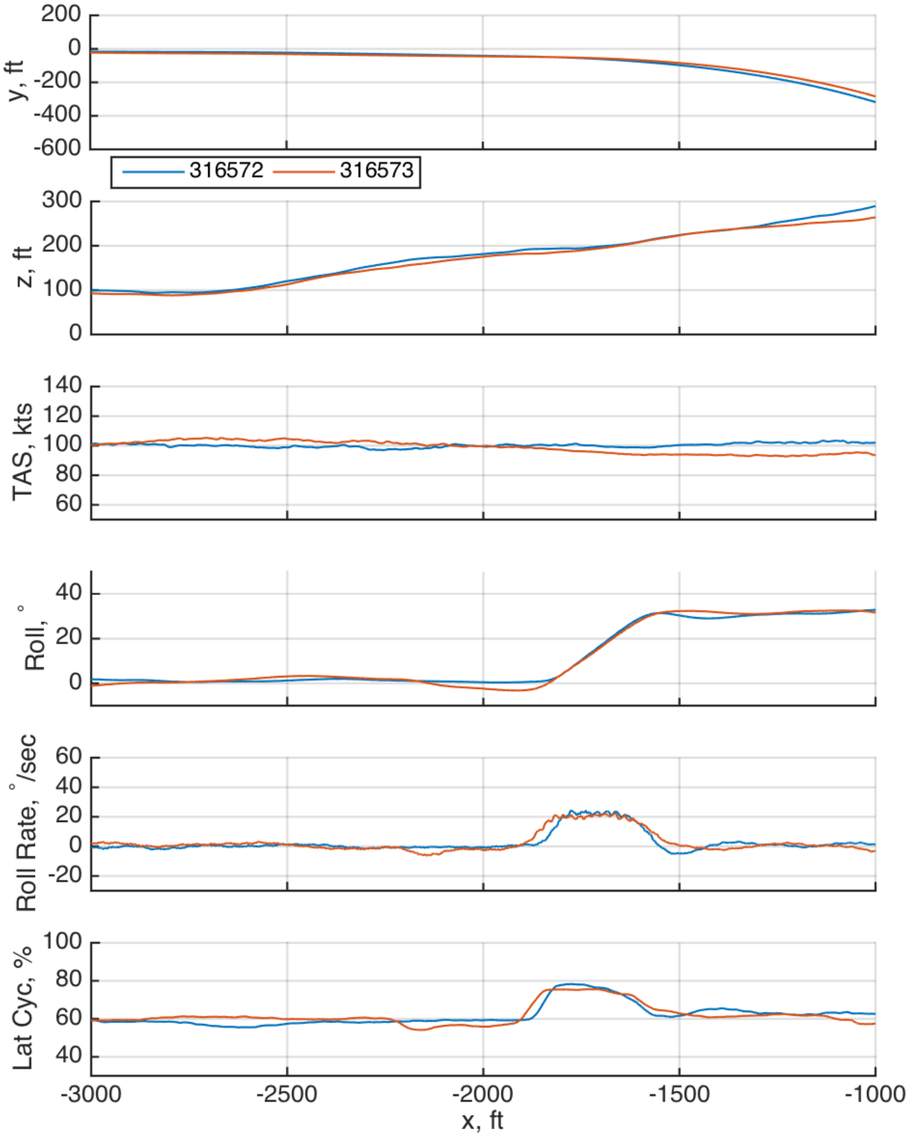


Figure 170: EH-60L M34 test condition, 95 knots, level approach, establish 6° climb then right bank.

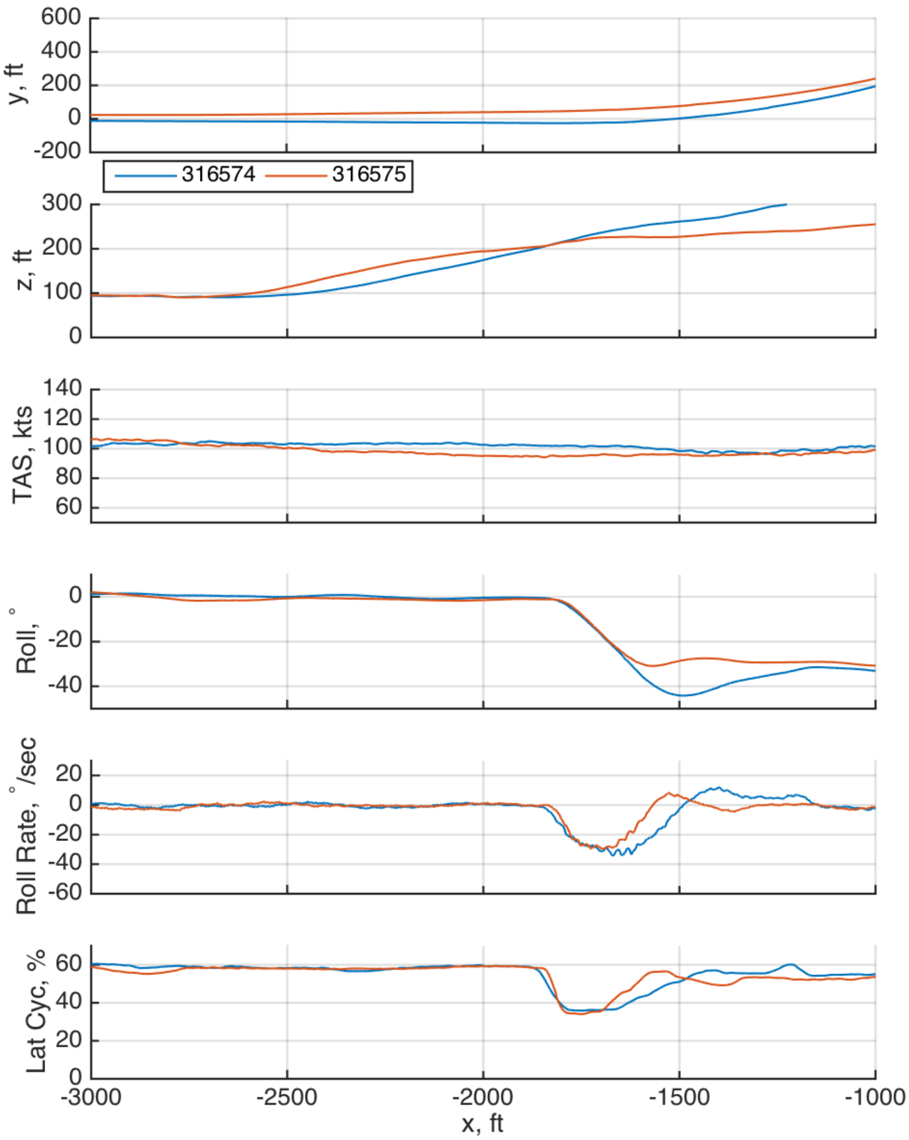


Figure 171: EH-60L M35 test condition, 95 knots, level approach, establish 6° climb then left bank.

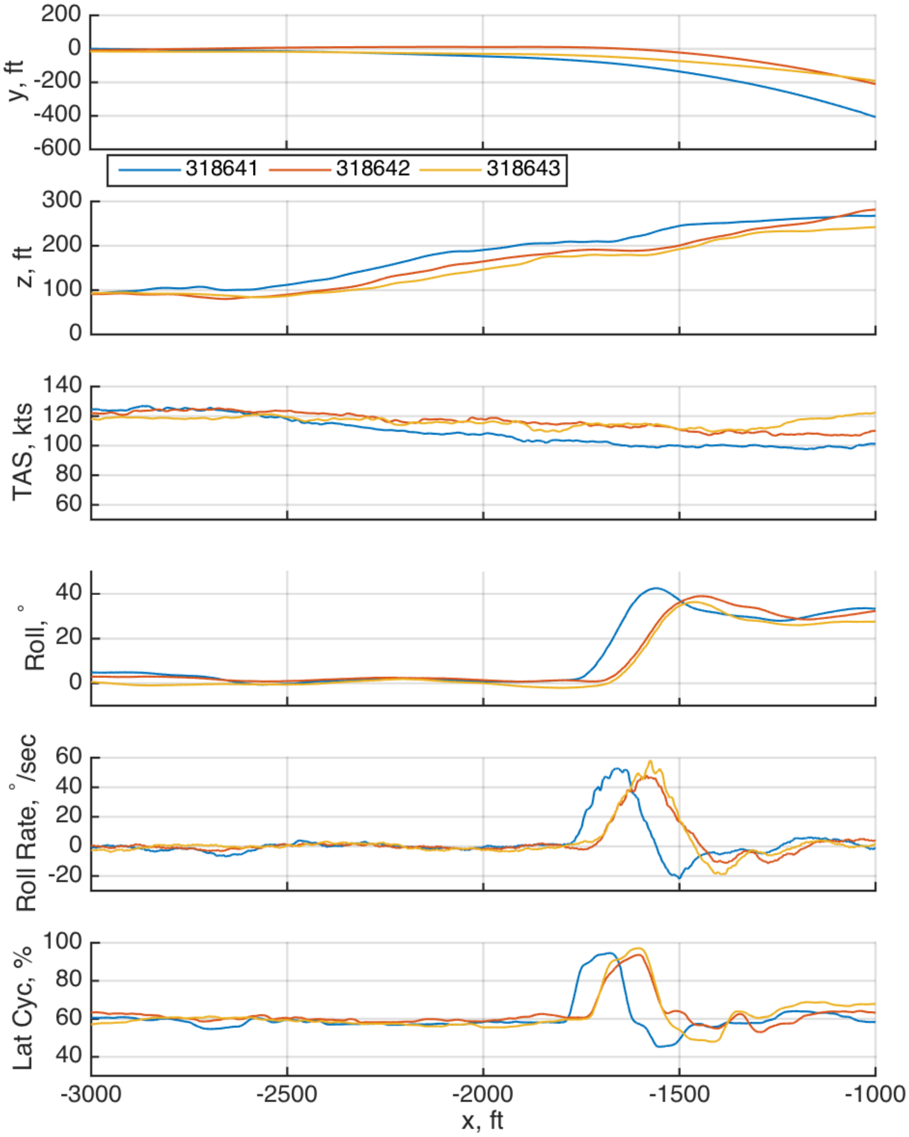


Figure 172: EH-60L M36 test condition, 110 knots, level approach, establish 6° climb then right bank.

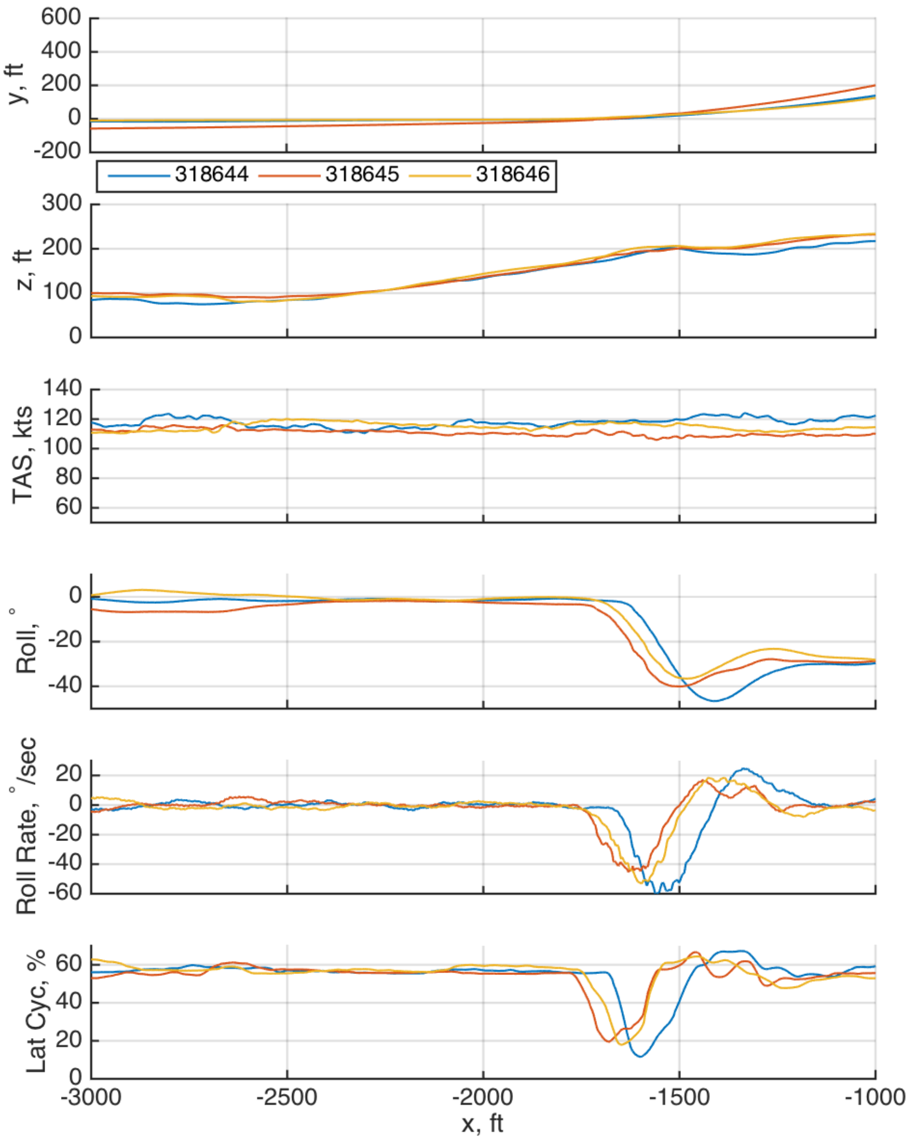


Figure 173: EH-60L M37 test condition, 110 knots, level approach, establish 6° climb then left bank.

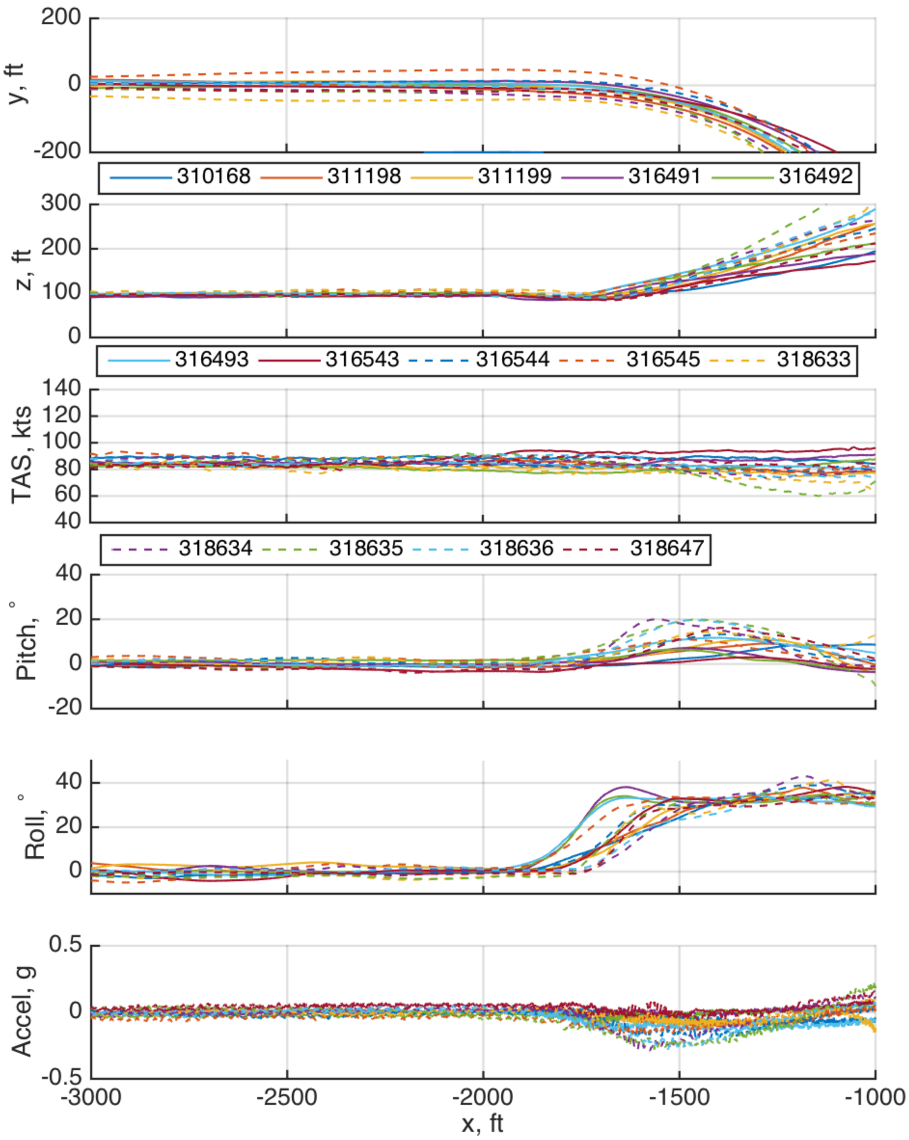


Figure 174: EH-60L M38 test condition, 80 knots, level approach, initiate 6° climb and right bank.

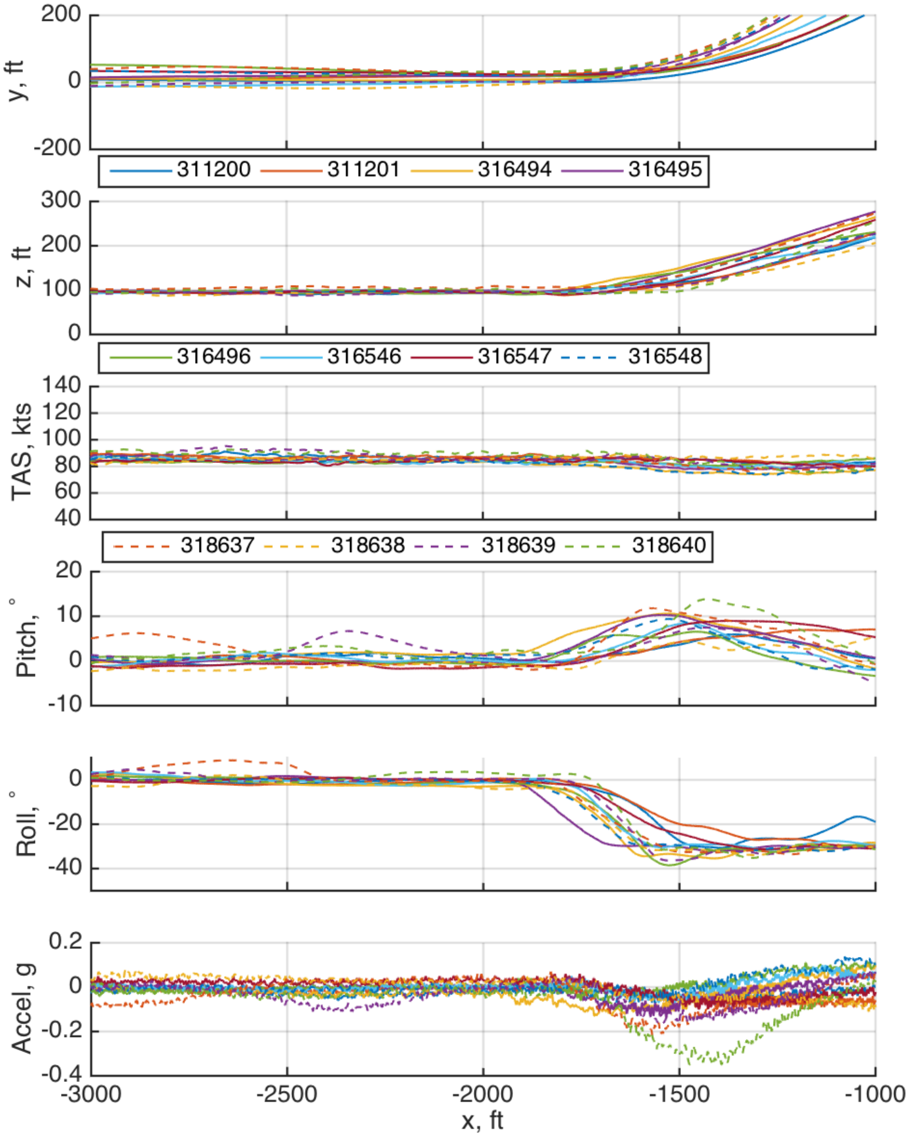


Figure 175: EH-60L M39 test condition, 80 knots, level approach, initiate 6° climb and left bank.

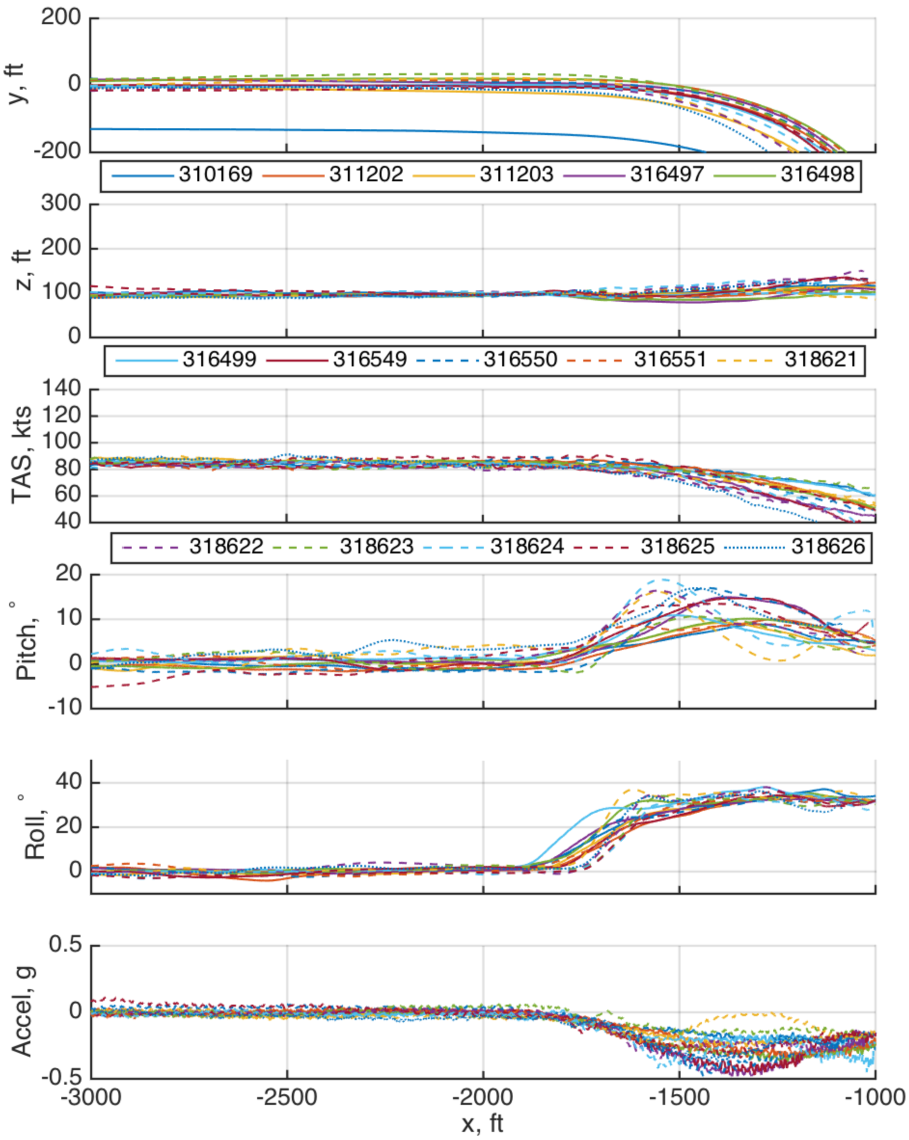


Figure 176: EH-60L M40 test condition, 80 knots, level approach, initiate deceleration and right bank.

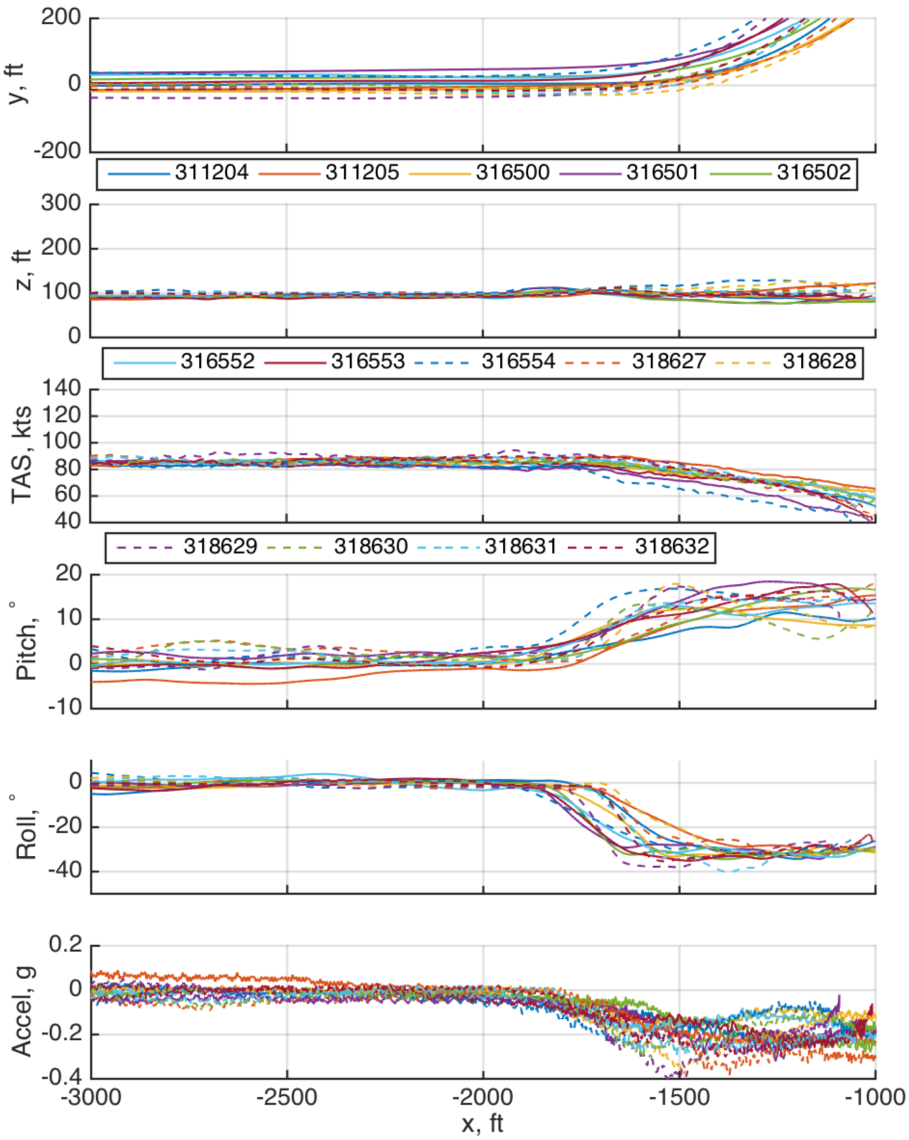


Figure 177: EH-60L M41 test condition, 80 knots, level approach, initiate deceleration and left bank.

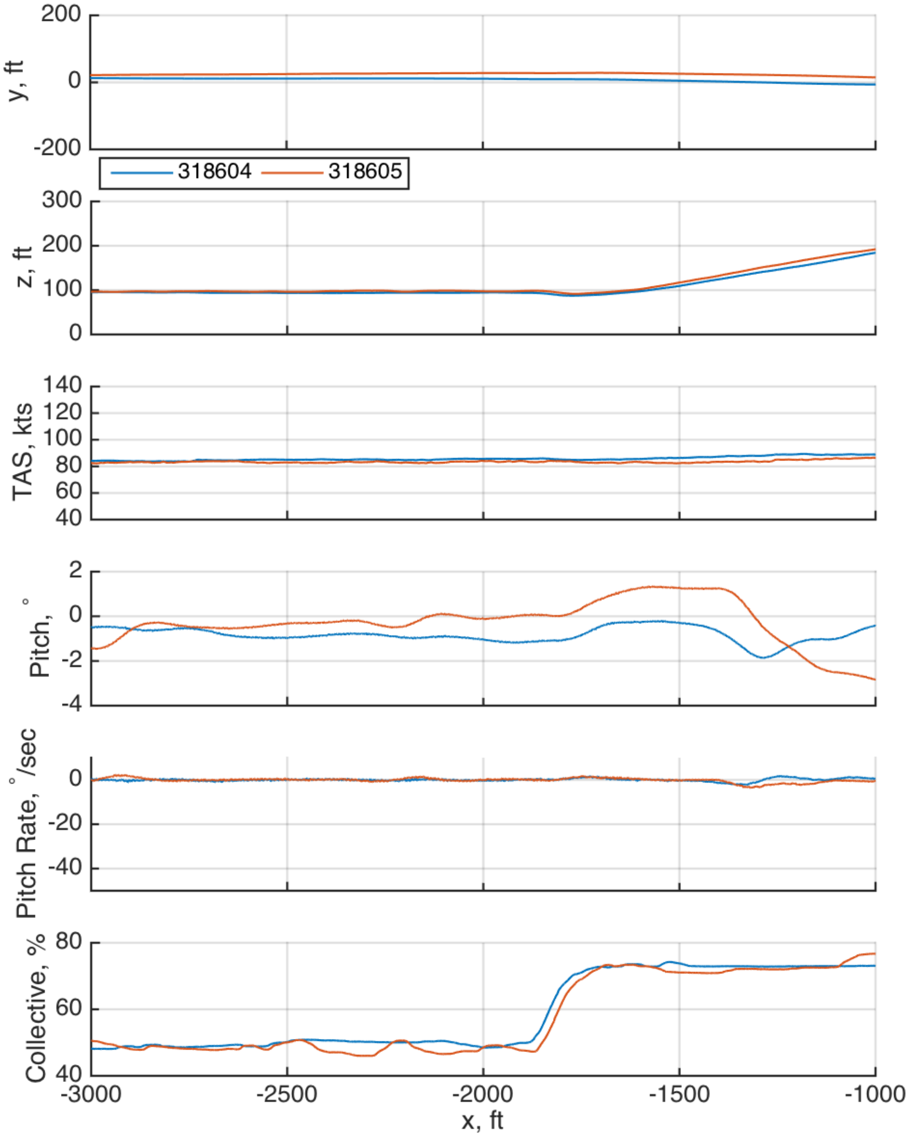


Figure 178: EH-60L M42 test condition, 80 knots, level approach, pull-up to 6° and hold.

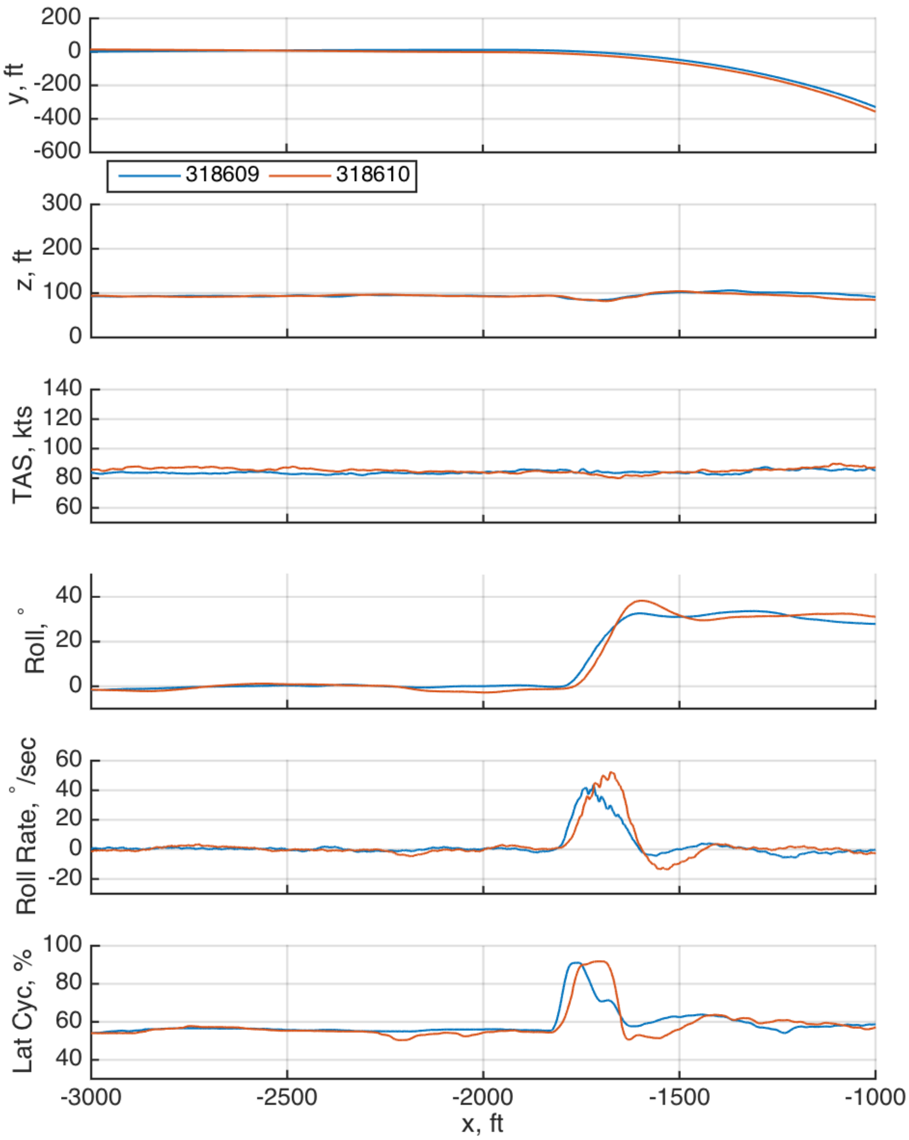


Figure 179: EH-60L M43 test condition, 80 knots, level approach, 30° right bank.

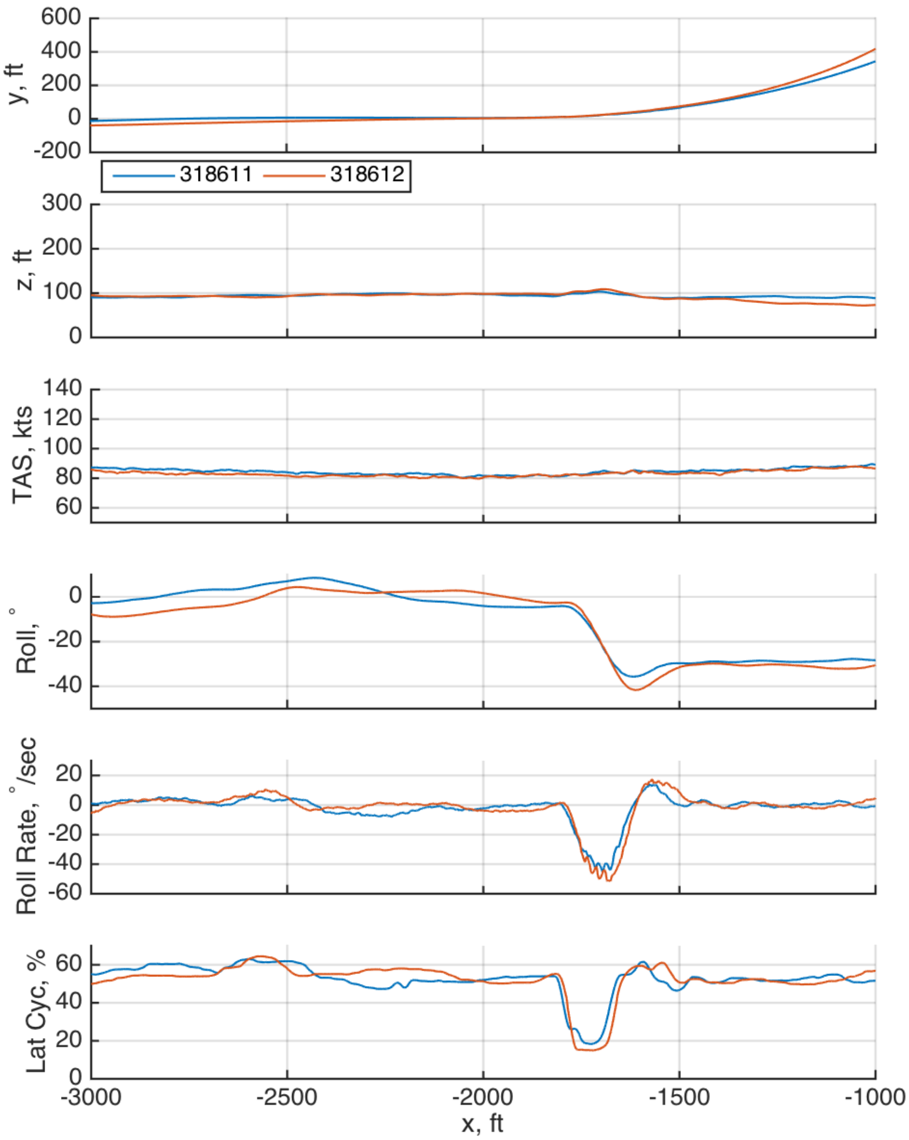


Figure 180: EH-60L M44 test condition, 80 knots, level approach, 30° left bank.

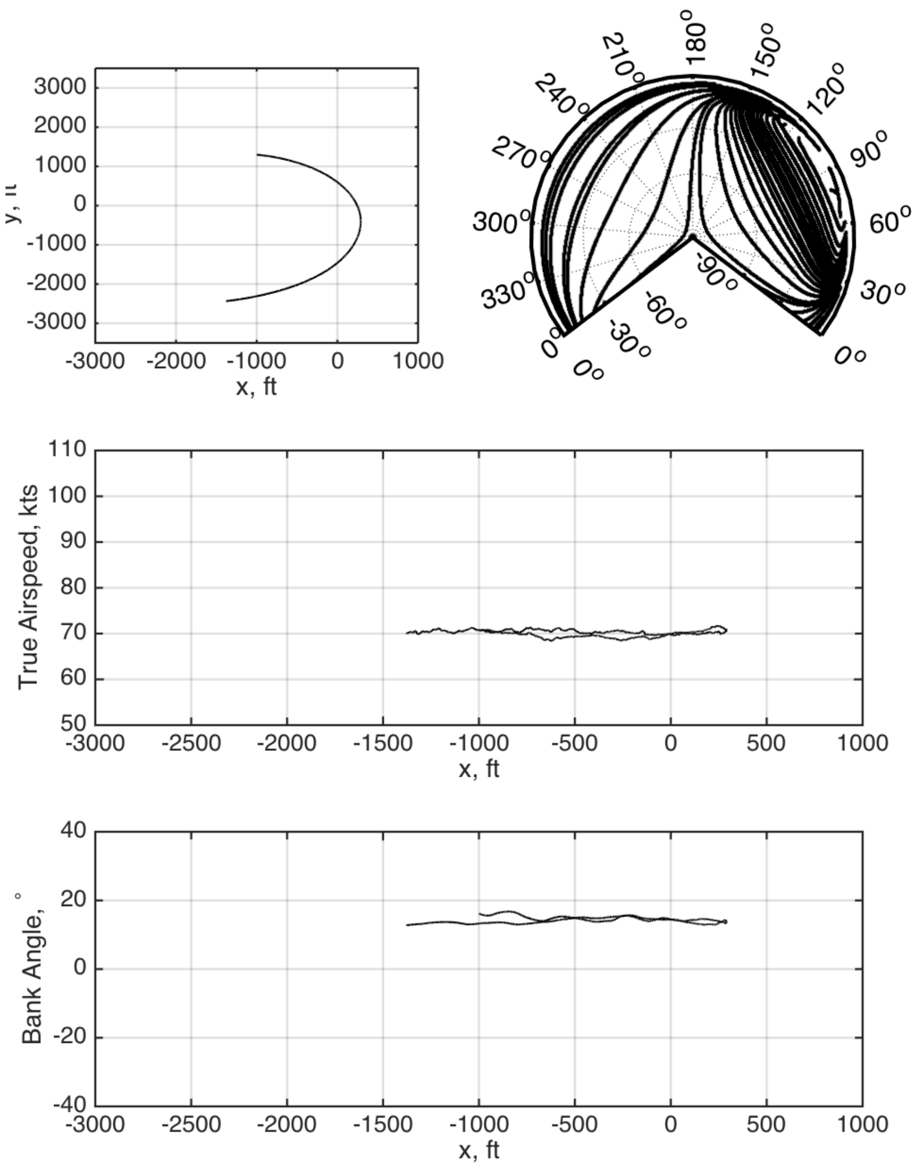


Figure 181: EH-60L S1 test condition, right 15° steady turn, 65 knots, run 318578.

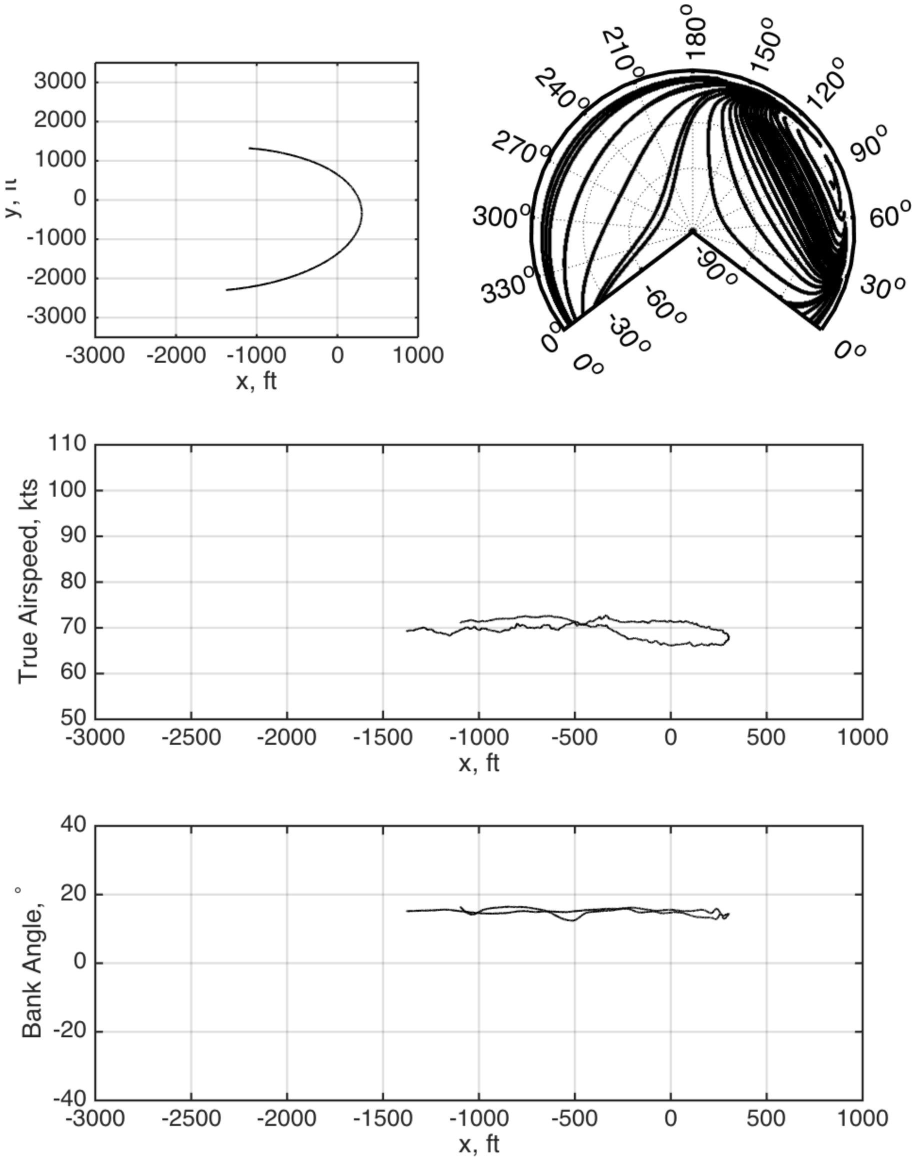


Figure 182: EH-60L S1 test condition, right 15° steady turn, 65 knots, run 318579.

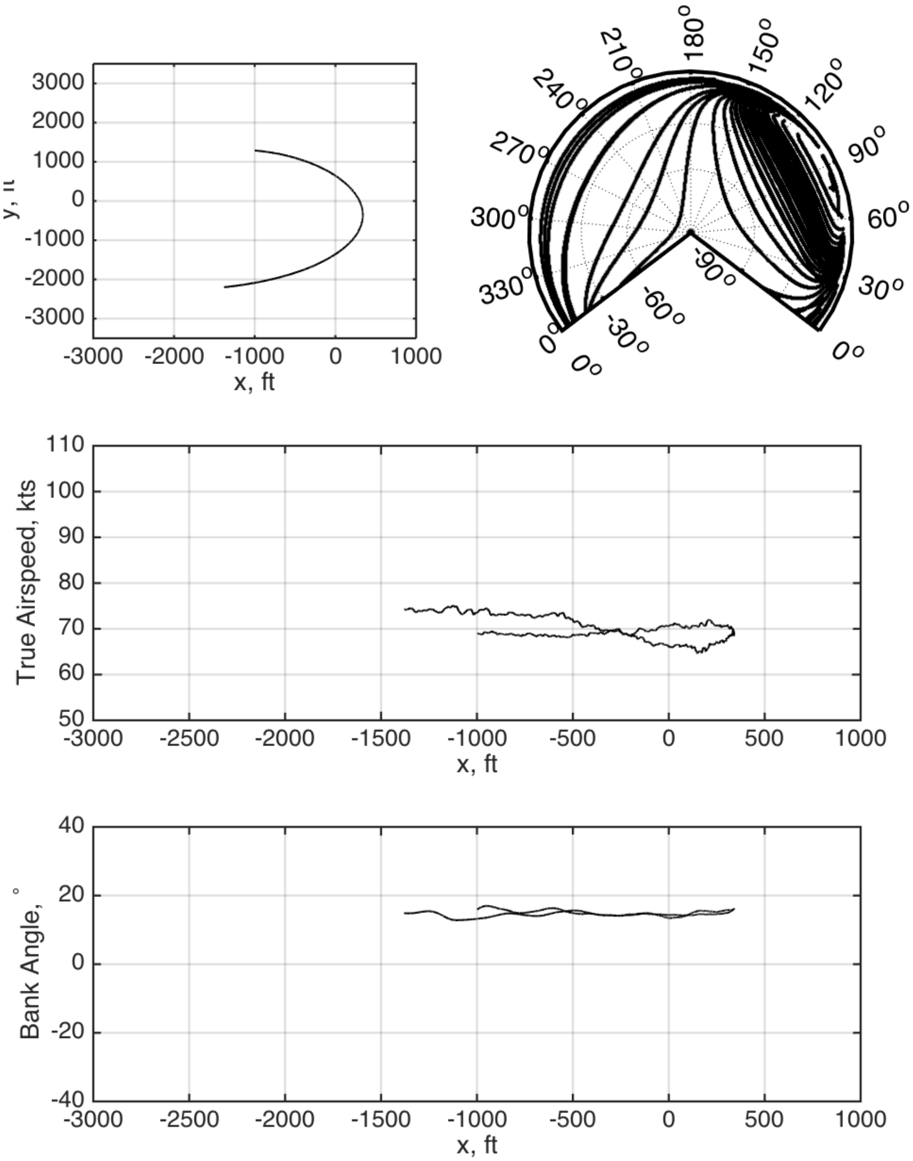


Figure 183: EH-60L S1 test condition, right 15° steady turn, 65 knots, run 318580.

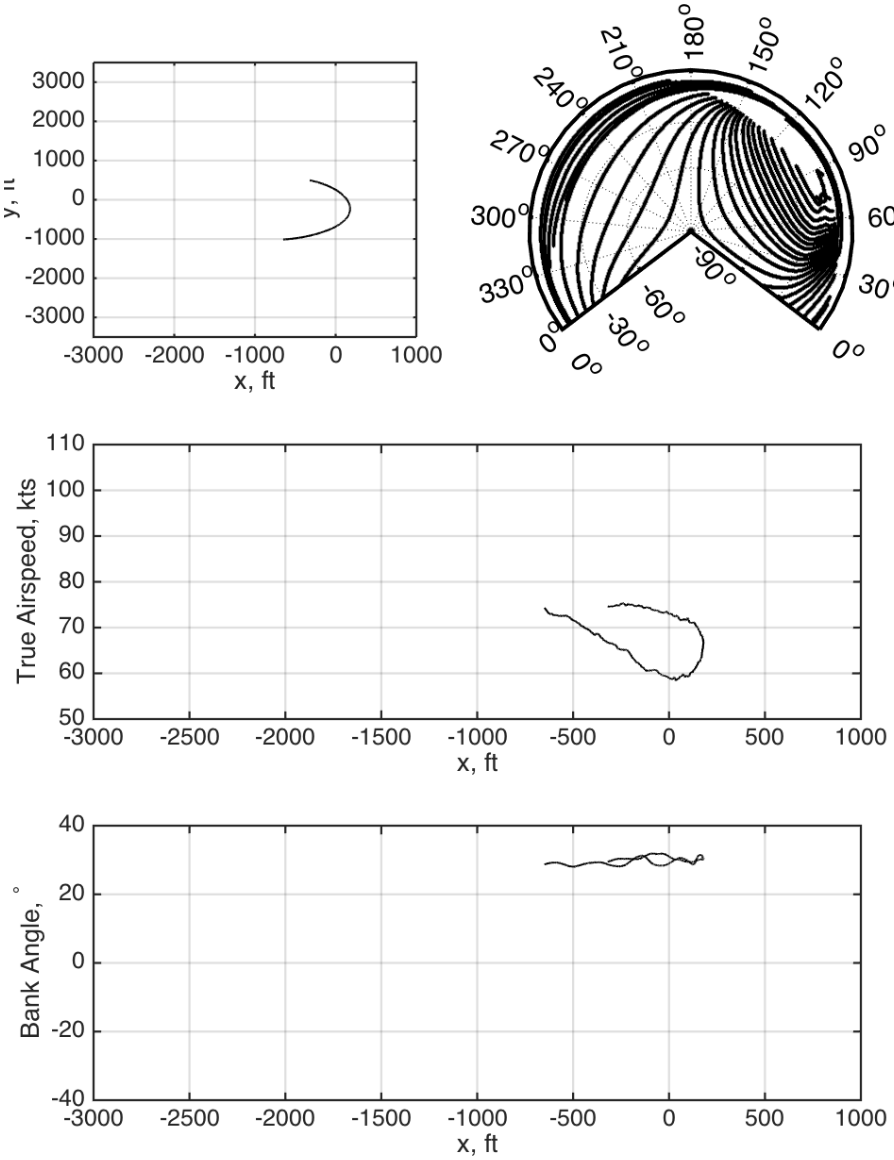


Figure 184: EH-60L S2 test condition, right 30° steady turn, 65 knots, run 318581.

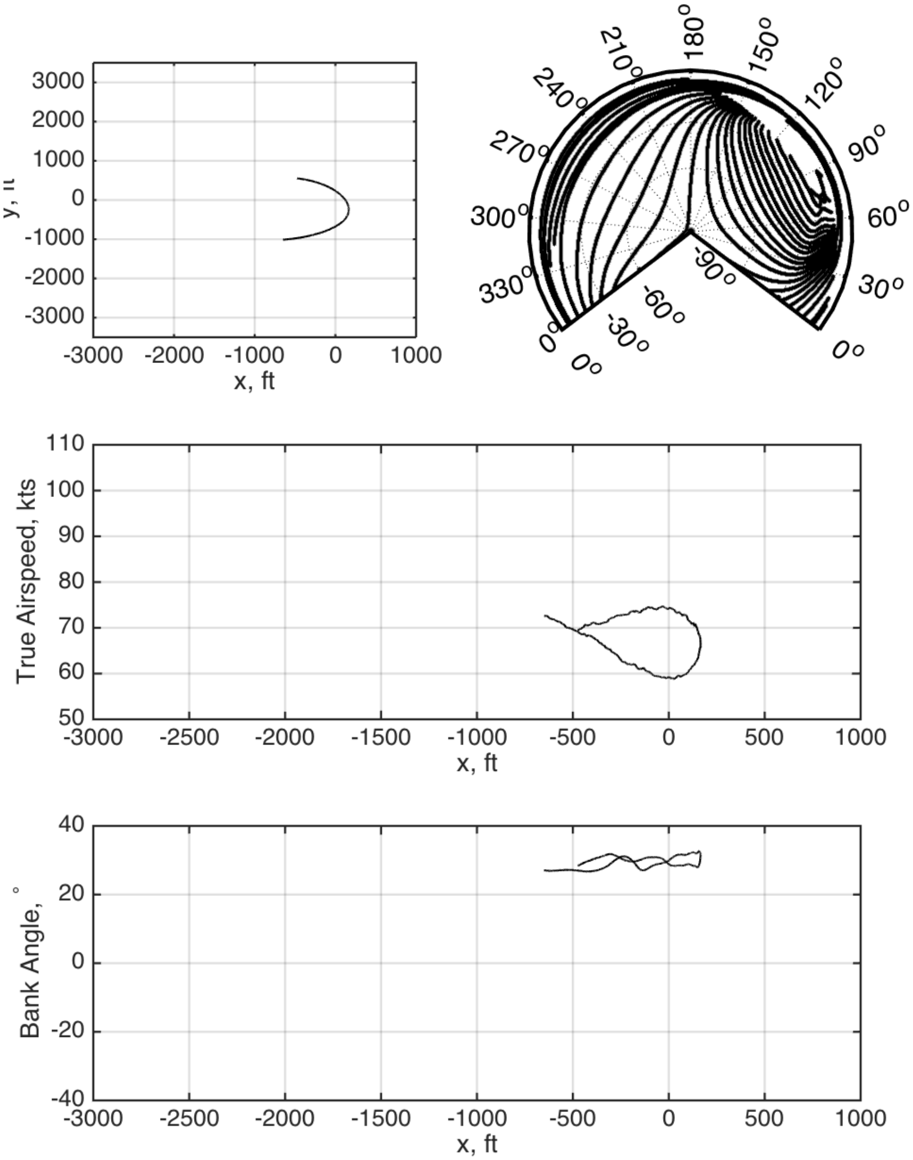


Figure 185: EH-60L S2 test condition, right 30° steady turn, 65 knots, run 318582.

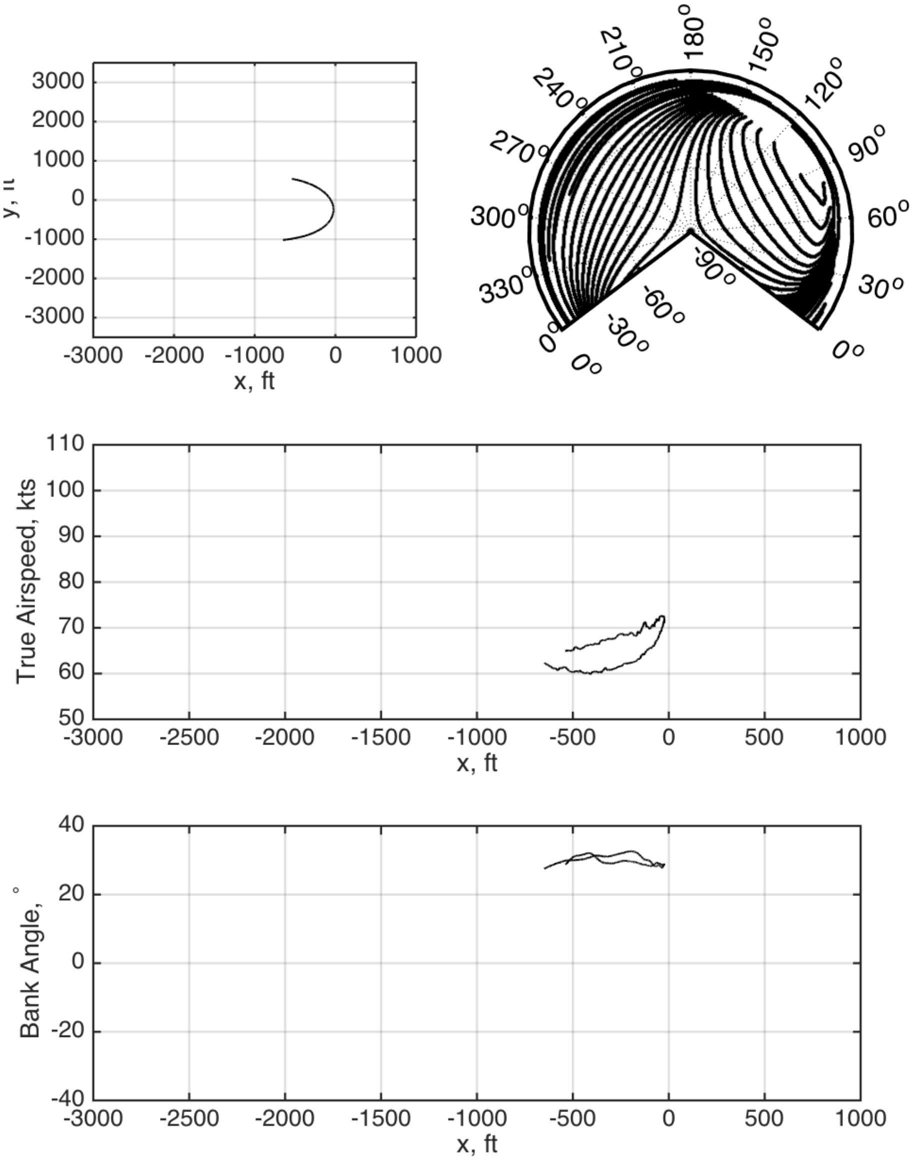


Figure 186: EH-60L S2 test condition, right 30° steady turn, 65 knots, run 318583.

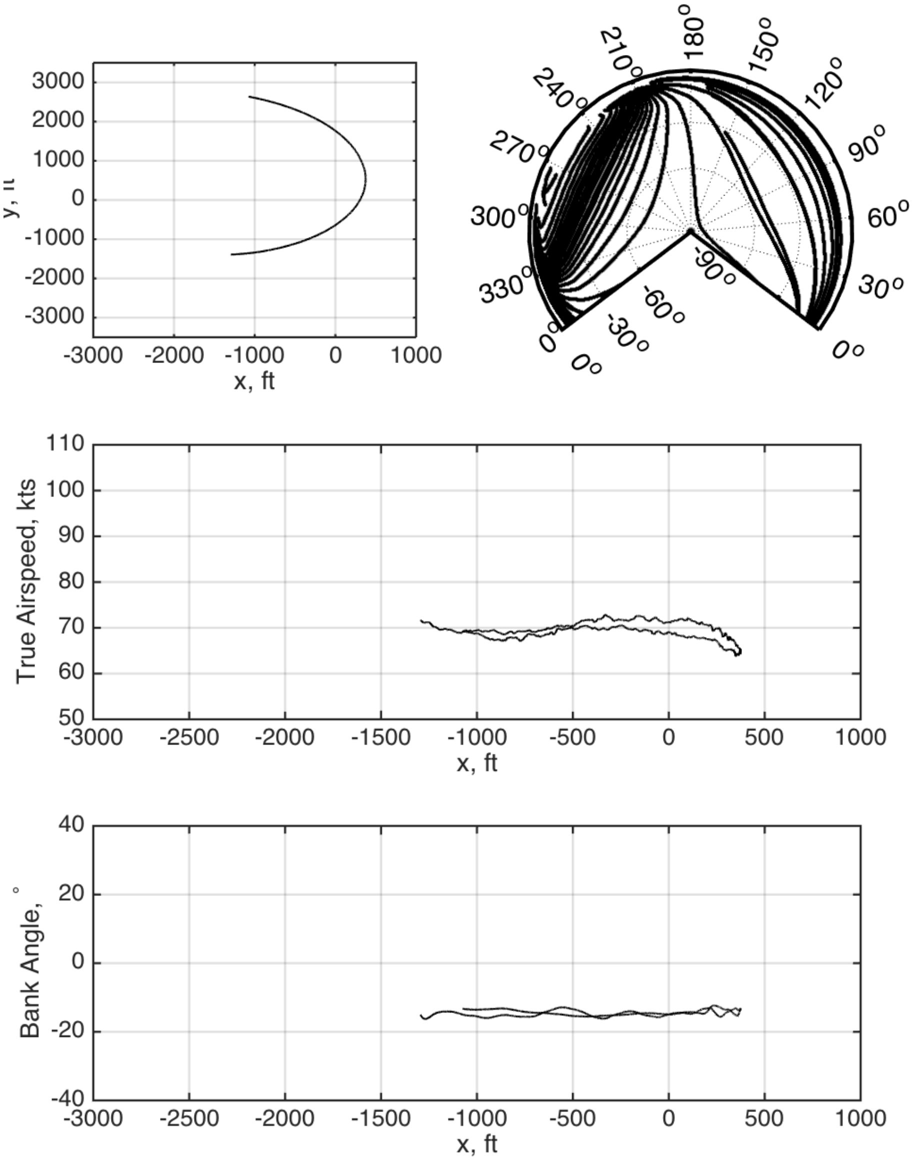


Figure 187: EH-60L S3 test condition, left 15° steady turn, 65 knots, run 318584.

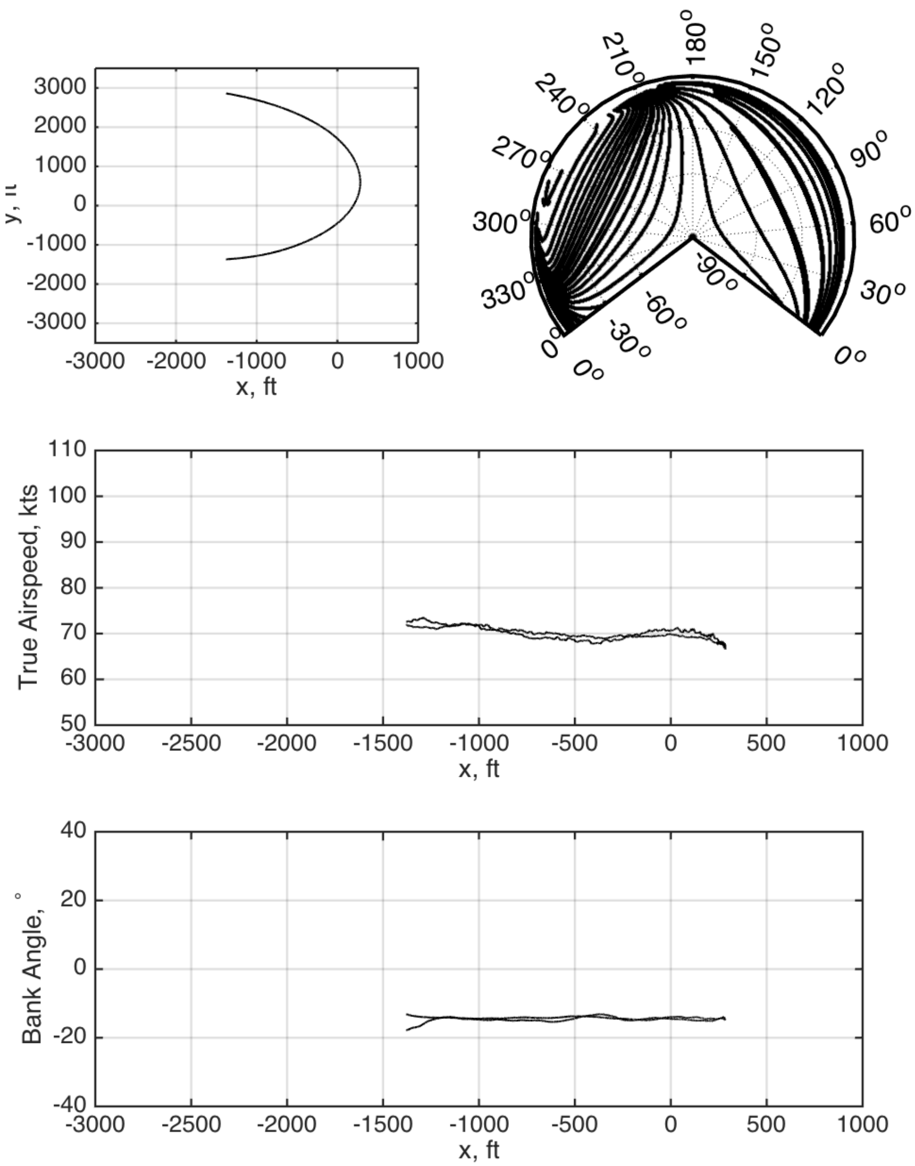


Figure 188: EH-60L S3 test condition, left 15° steady turn, 65 knots, run 318585.

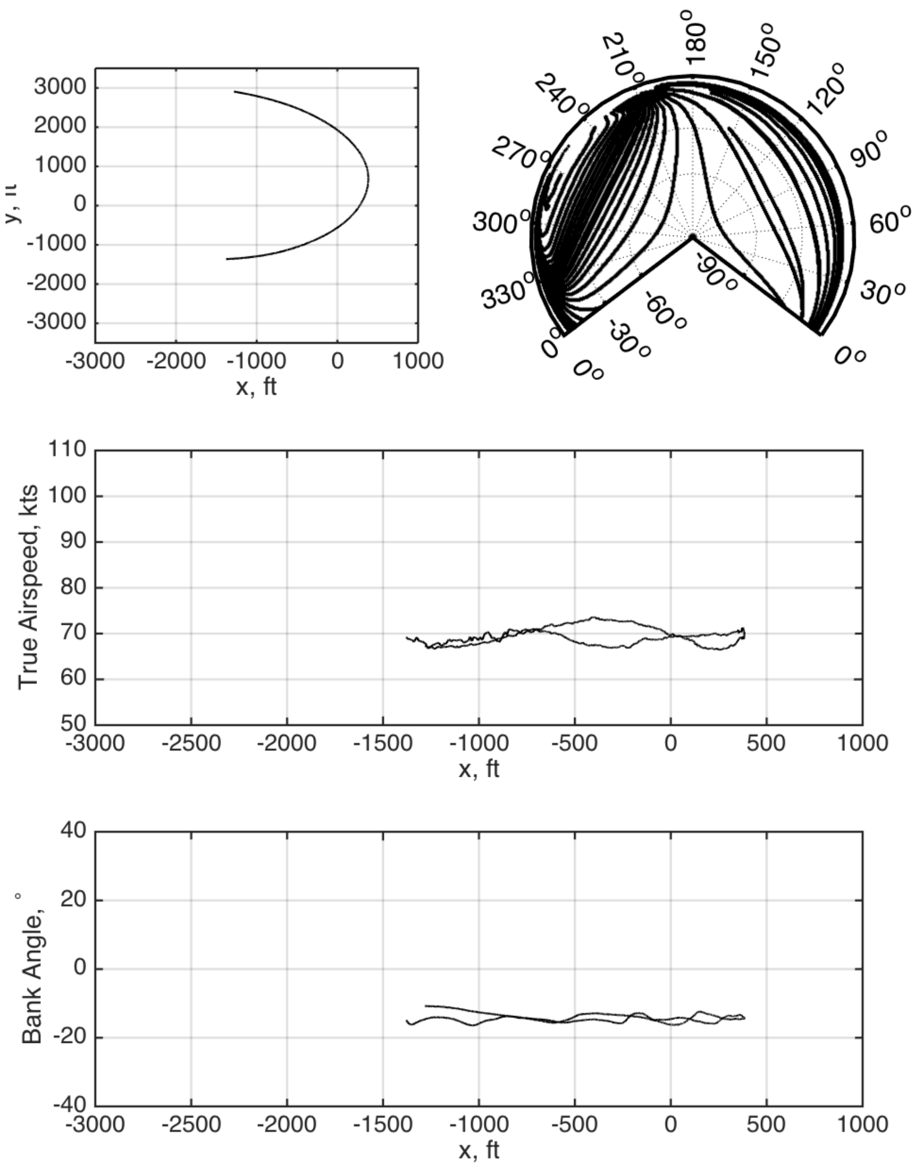


Figure 189: EH-60L S3 test condition, left 15° steady turn, 65 knots, run 318586.

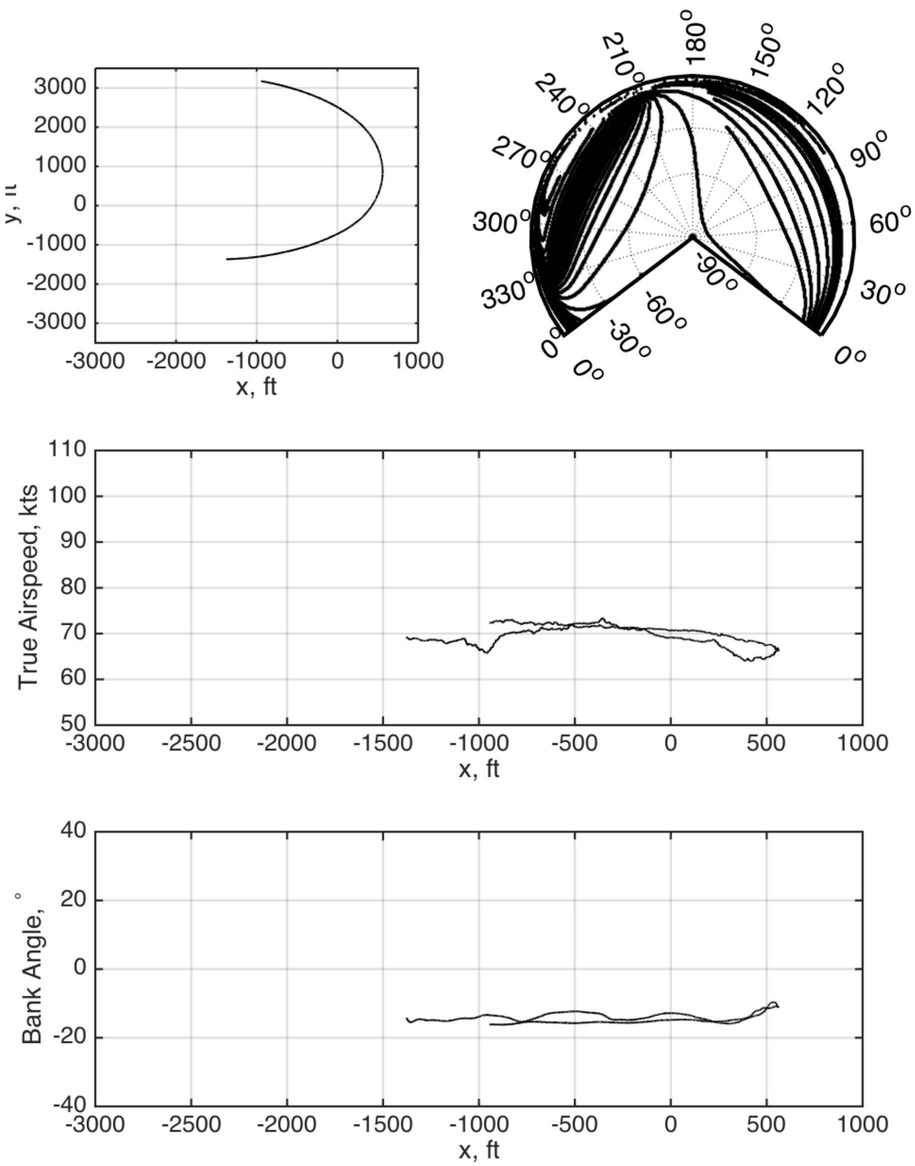


Figure 190: EH-60L S3 test condition, left 15° steady turn, 65 knots, run 318587.

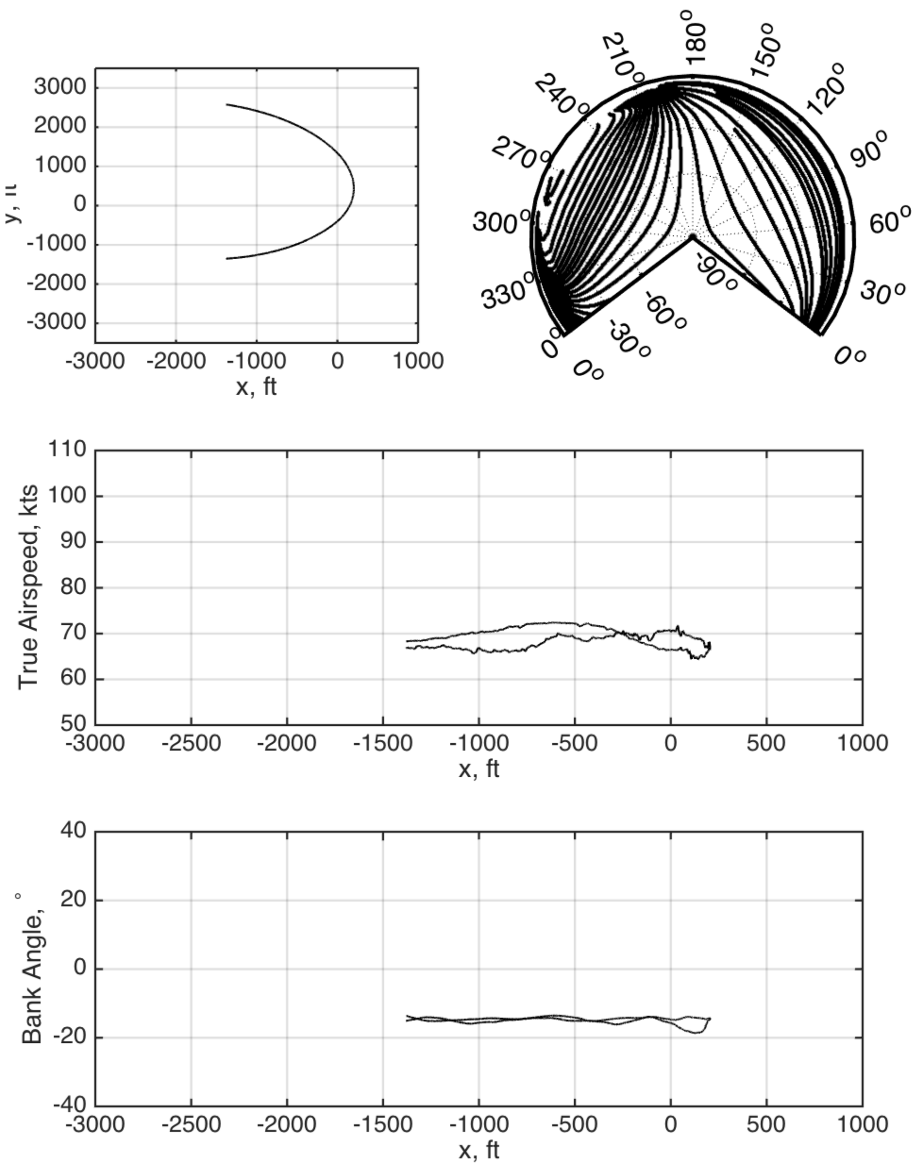


Figure 191: EH-60L S3 test condition, left 15° steady turn, 65 knots, run 318588.

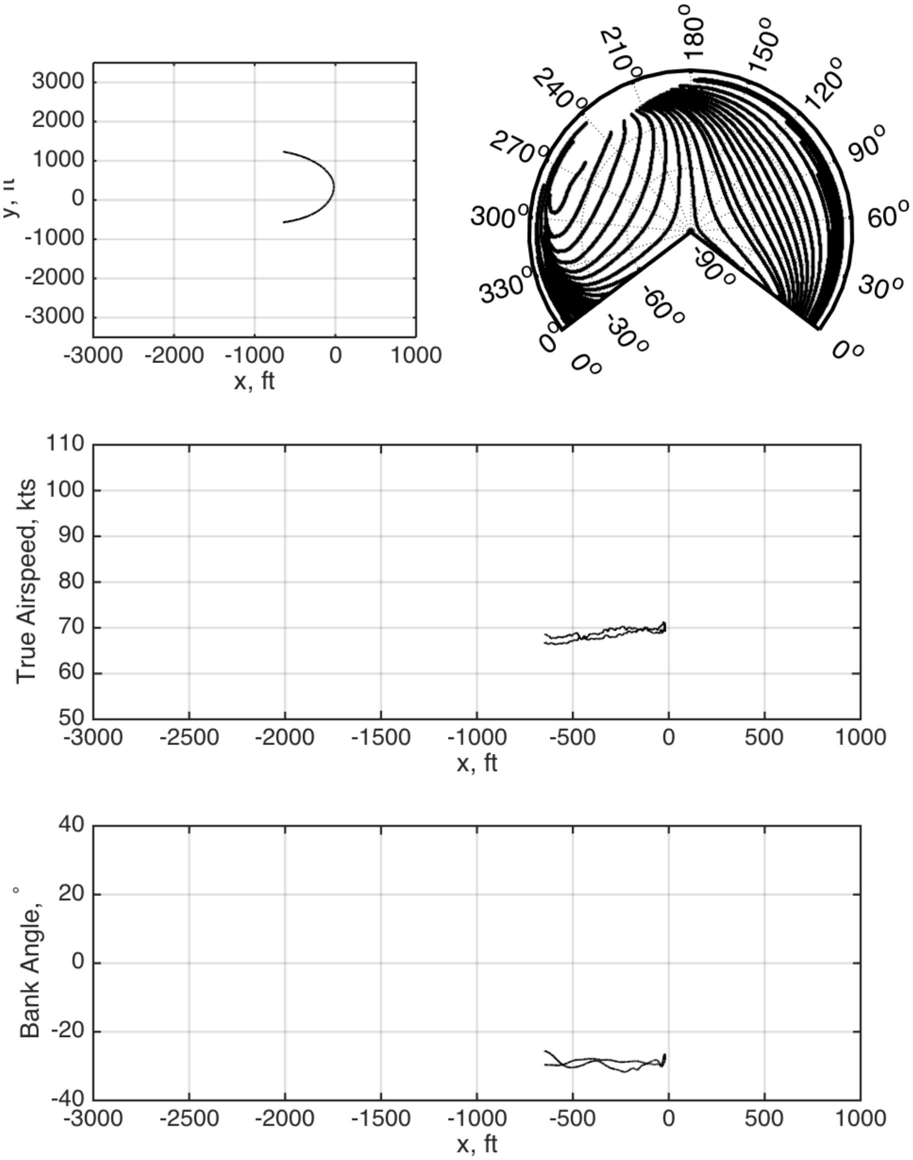


Figure 192: EH-60L S4 test condition, left 30° steady turn, 65 knots, run 318589.

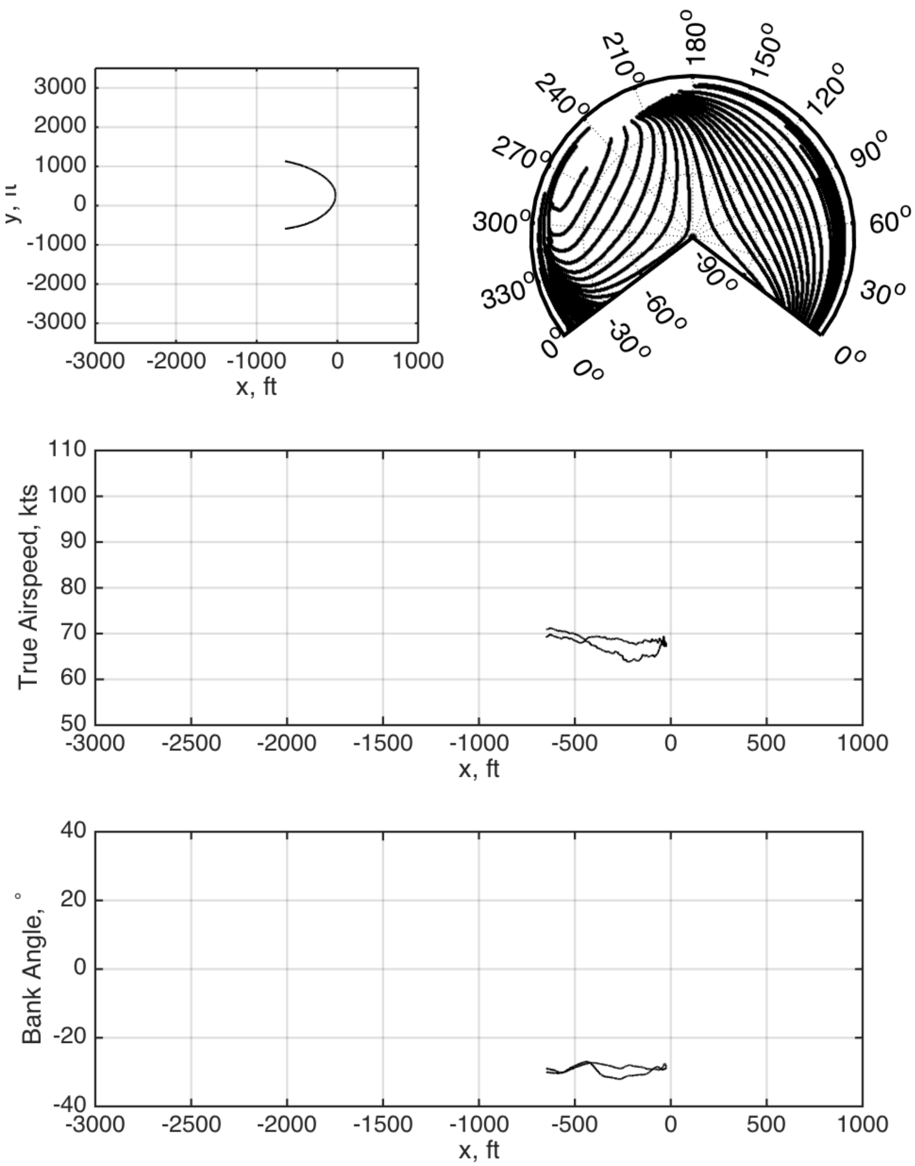


Figure 193: EH-60L S4 test condition, left 30° steady turn, 65 knots, run 318590.

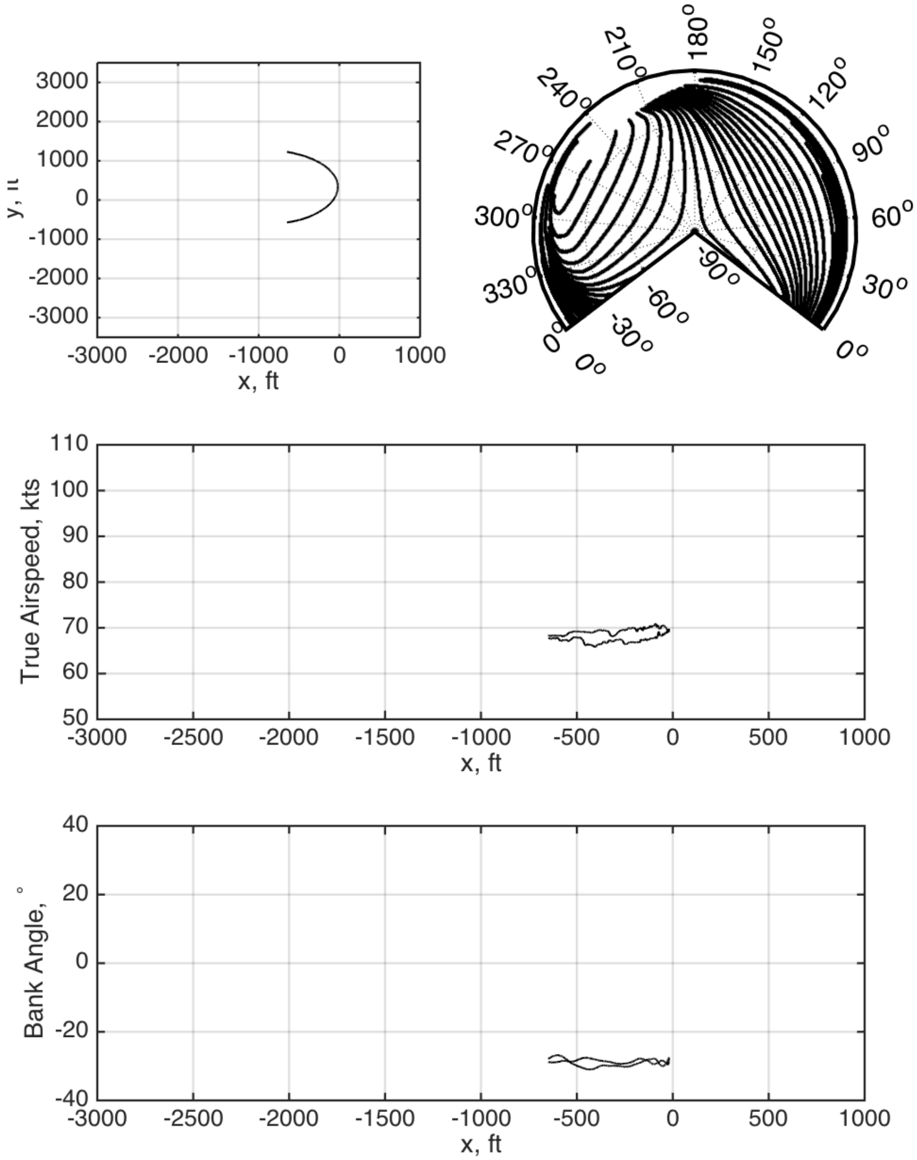


Figure 194: EH-60L S4 test condition, left 30° steady turn, 65 knots, run 318591.

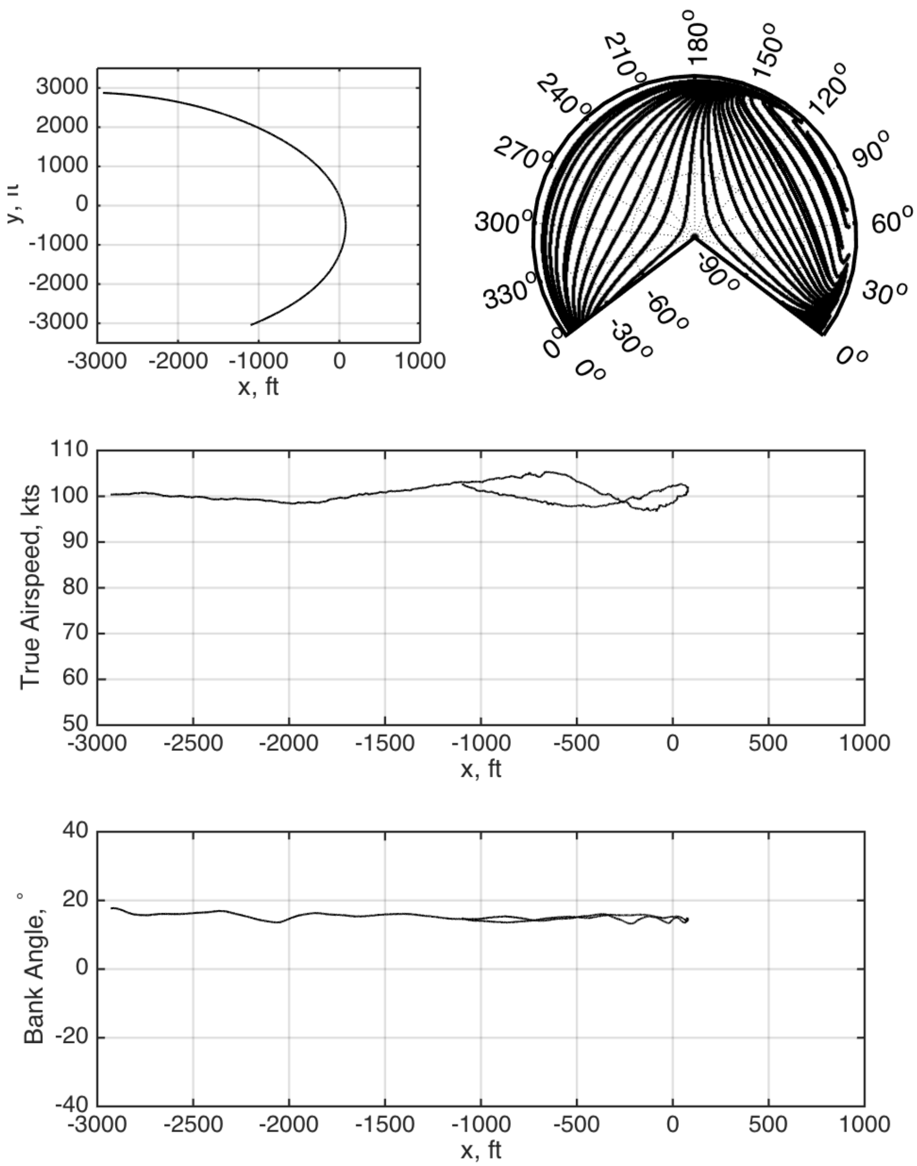


Figure 195: EH-60L S5 test condition, right 15° steady turn, 95 knots, run 318592.

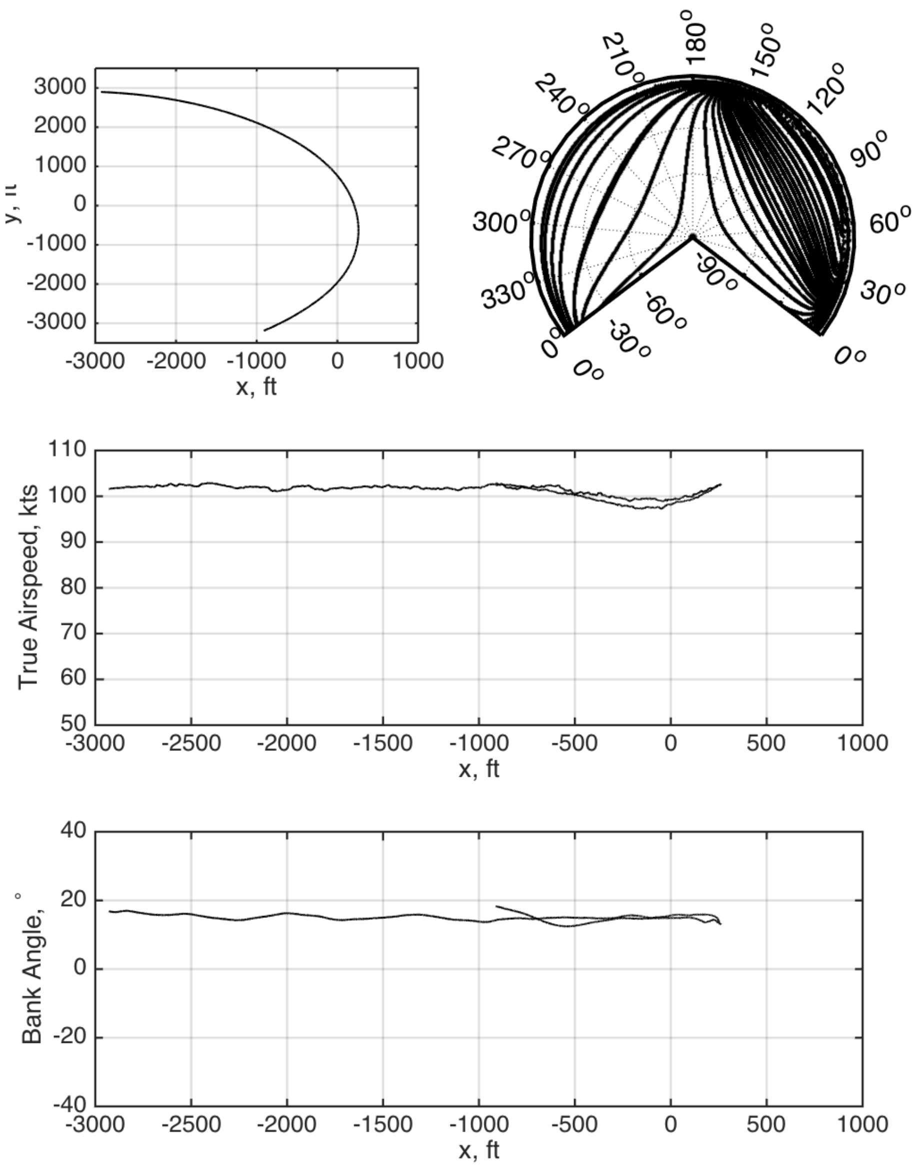


Figure 196: EH-60L S5 test condition, right 15° steady turn, 95 knots, run 318593.

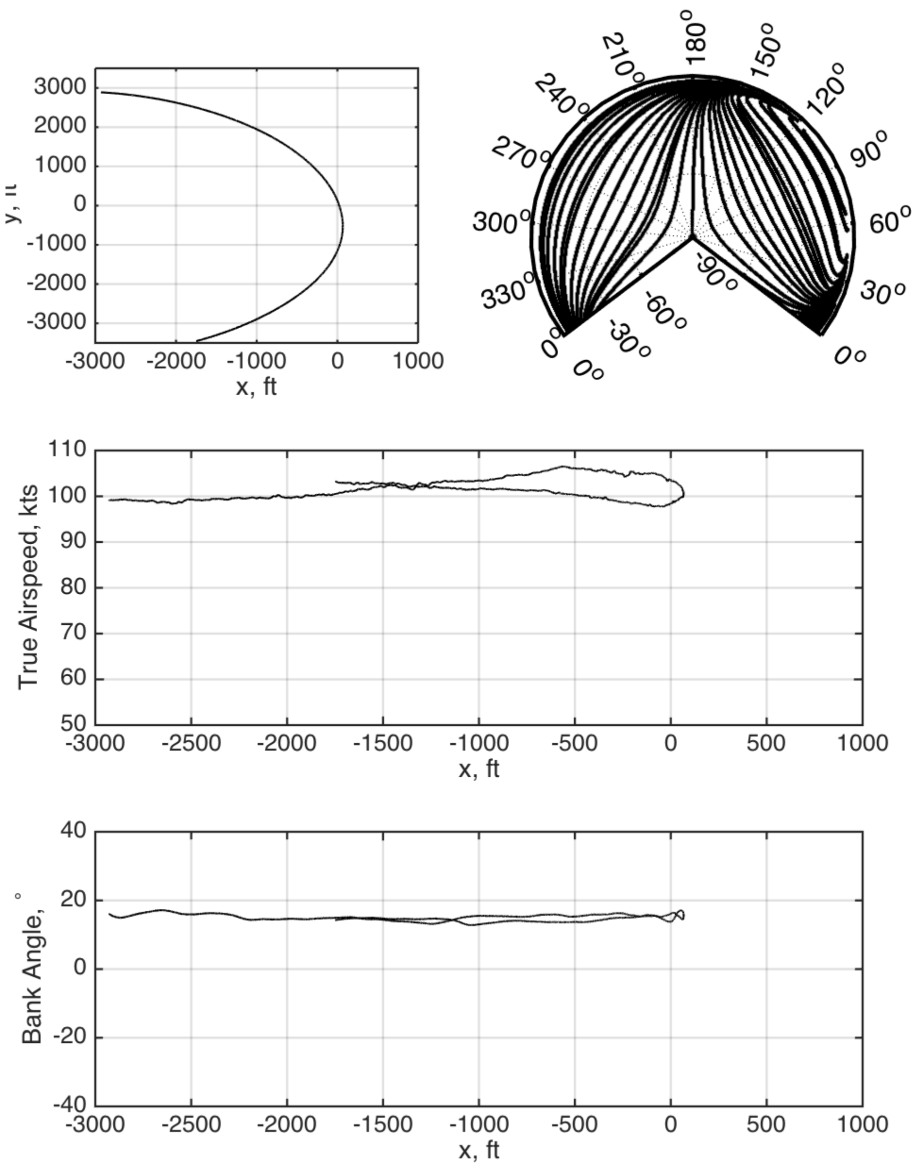


Figure 197: EH-60L S5 test condition, right 15° steady turn, 95 knots, run 318594.

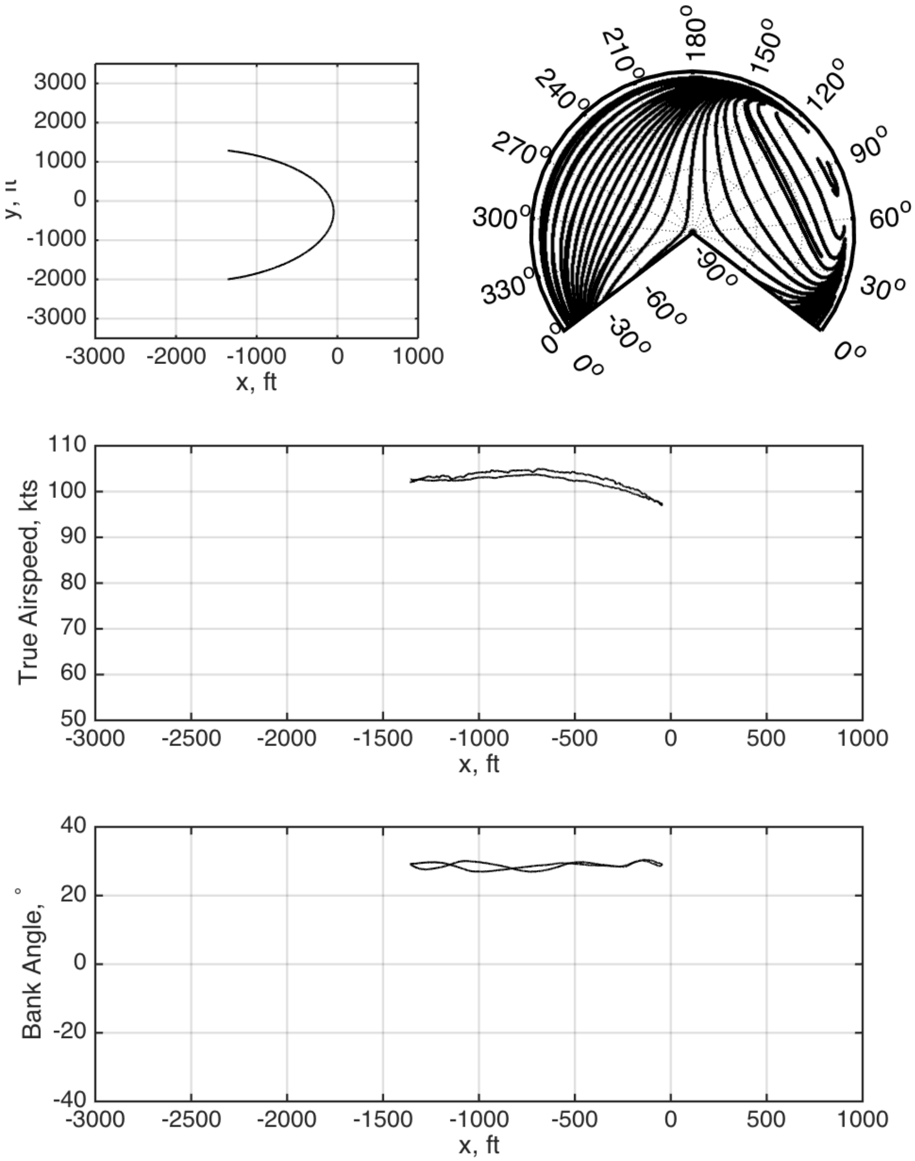


Figure 198: EH-60L S6 test condition, right 30° steady turn, 95 knots, run 318595.

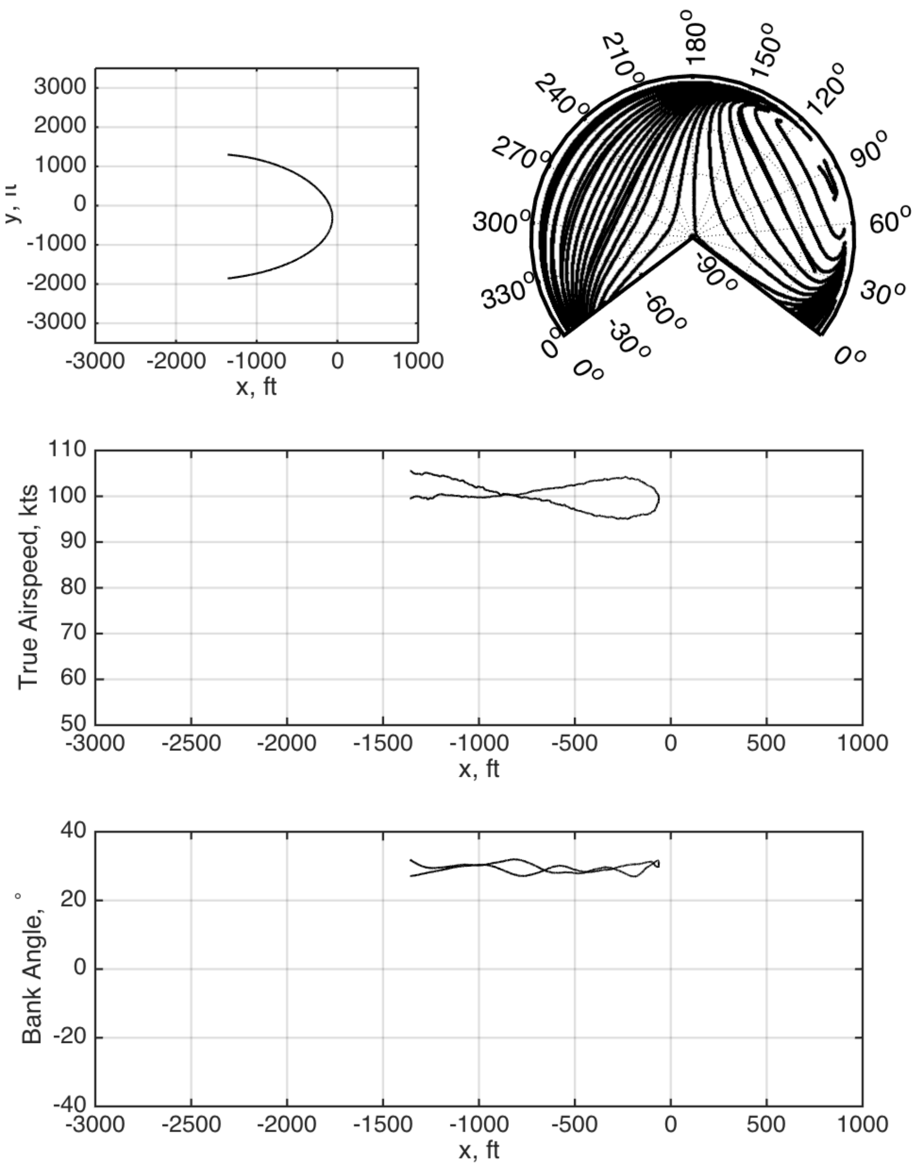


Figure 199: EH-60L S6 test condition, right 30° steady turn, 95 knots, run 318596.

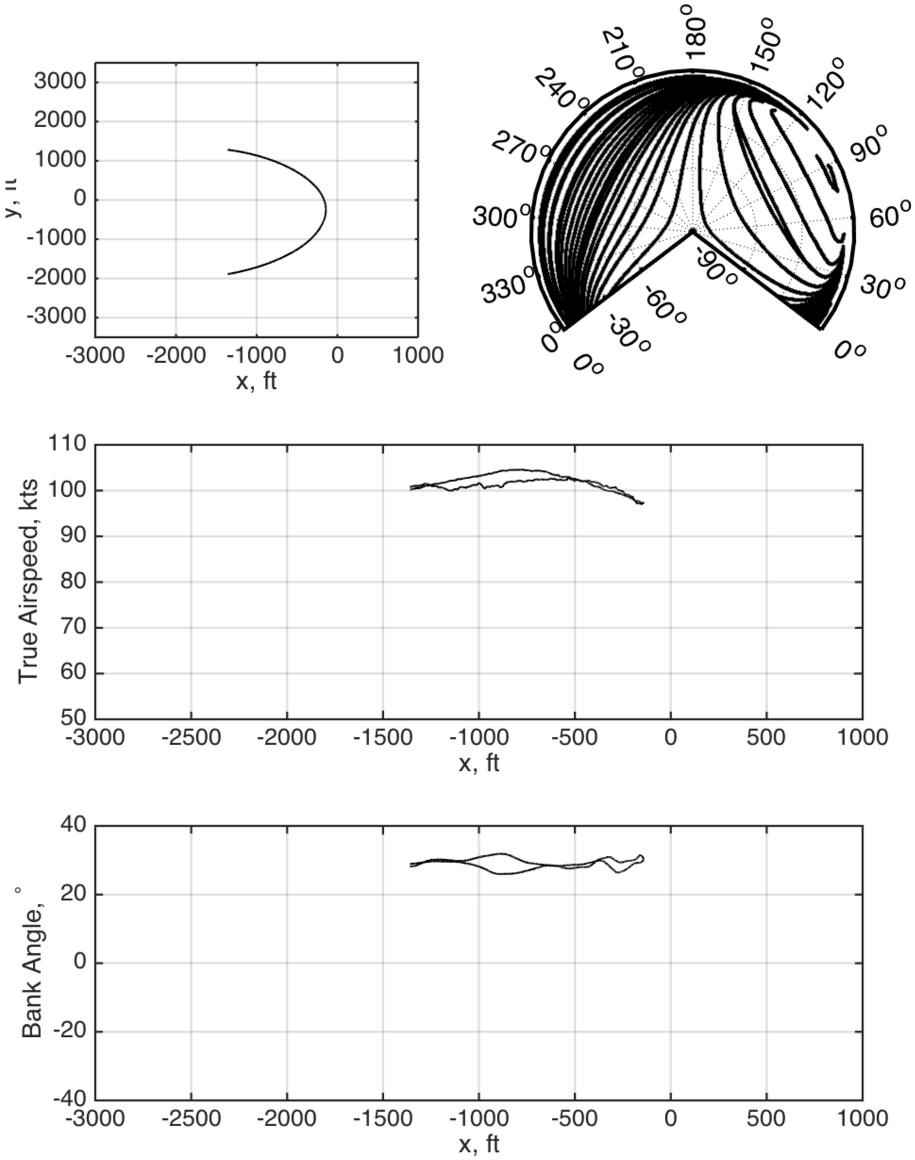


Figure 200: EH-60L S6 test condition, right 30° steady turn, 95 knots, run 318597.

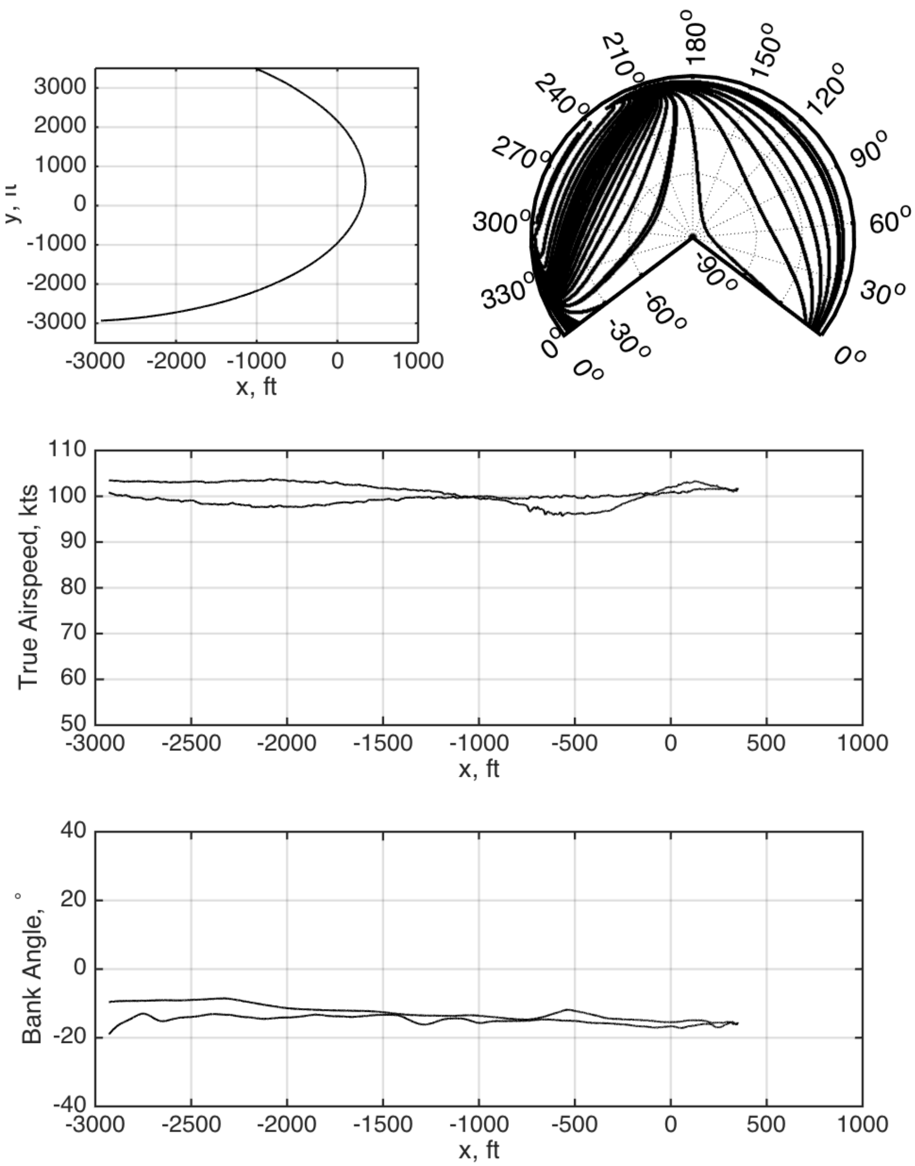


Figure 201: EH-60L S7 test condition, left 15° steady turn, 95 knots, run 318598.

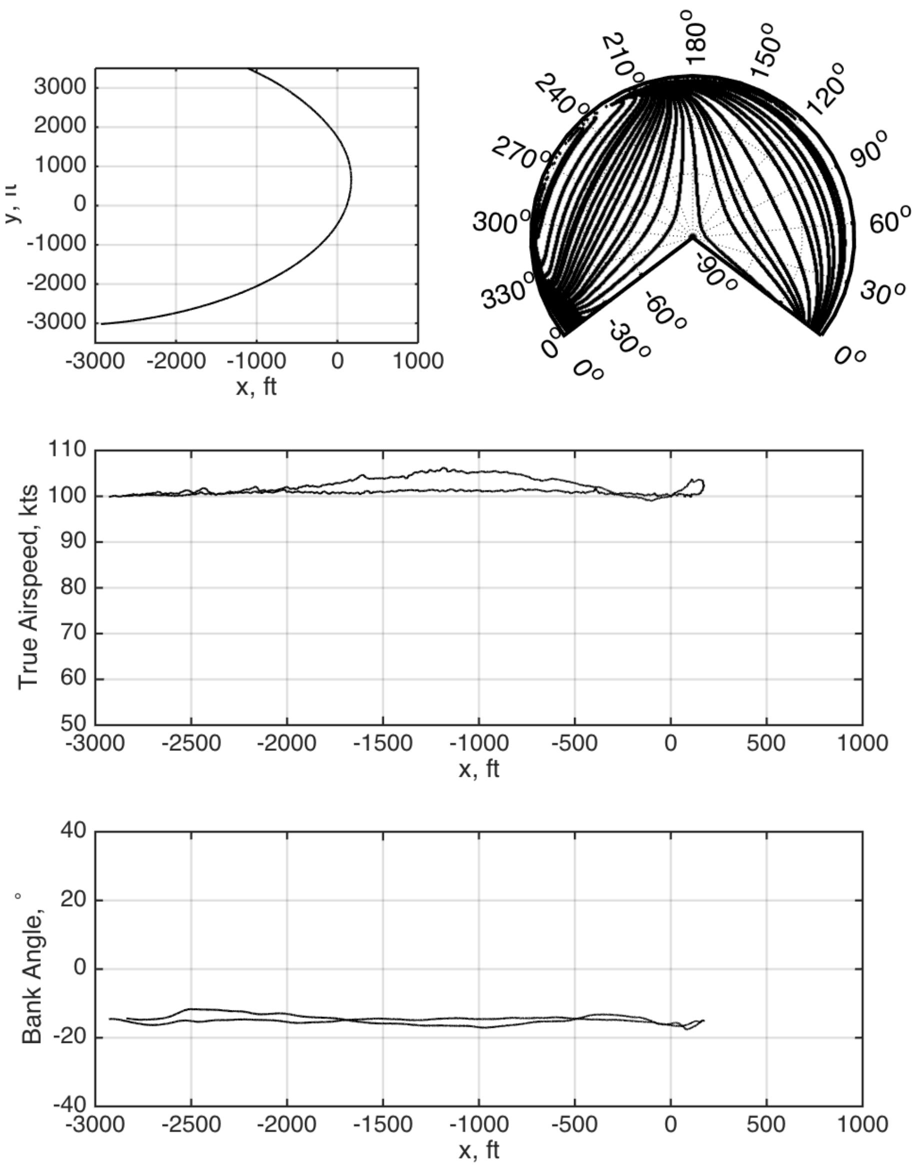


Figure 202: EH-60L S7 test condition, left 15° steady turn, 95 knots, run 318599.

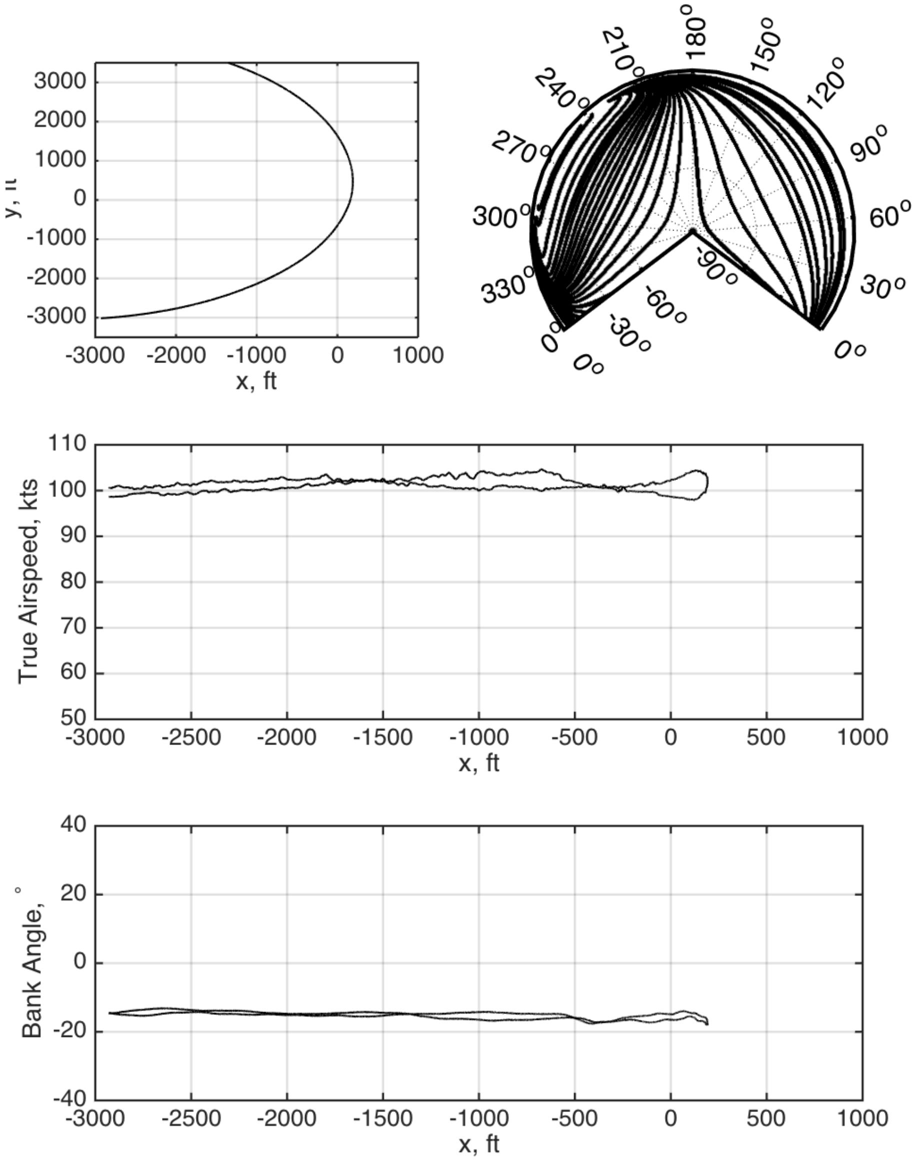


Figure 203: EH-60L S7 test condition, left 15° steady turn, 95 knots, run 318600.

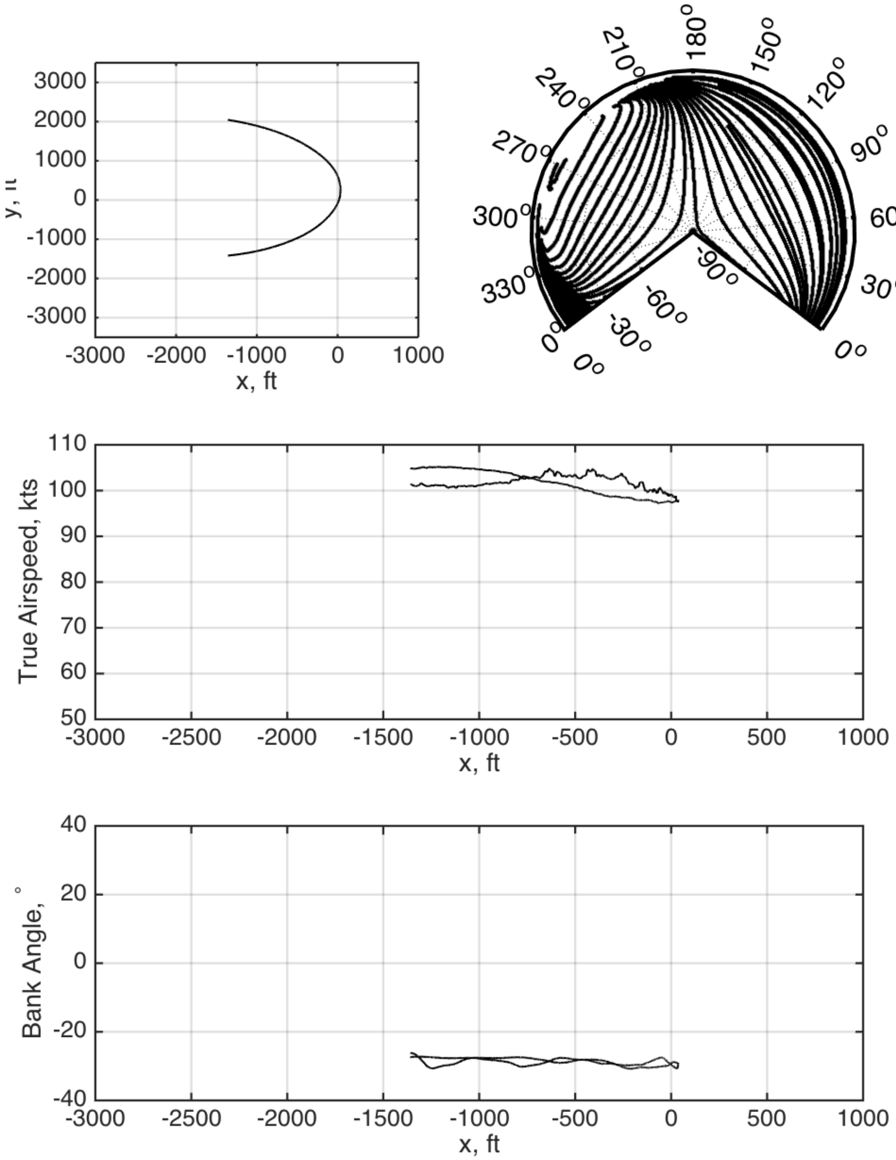


Figure 204: EH-60L S8 test condition, left 30° steady turn, 95 knots, run 318601.

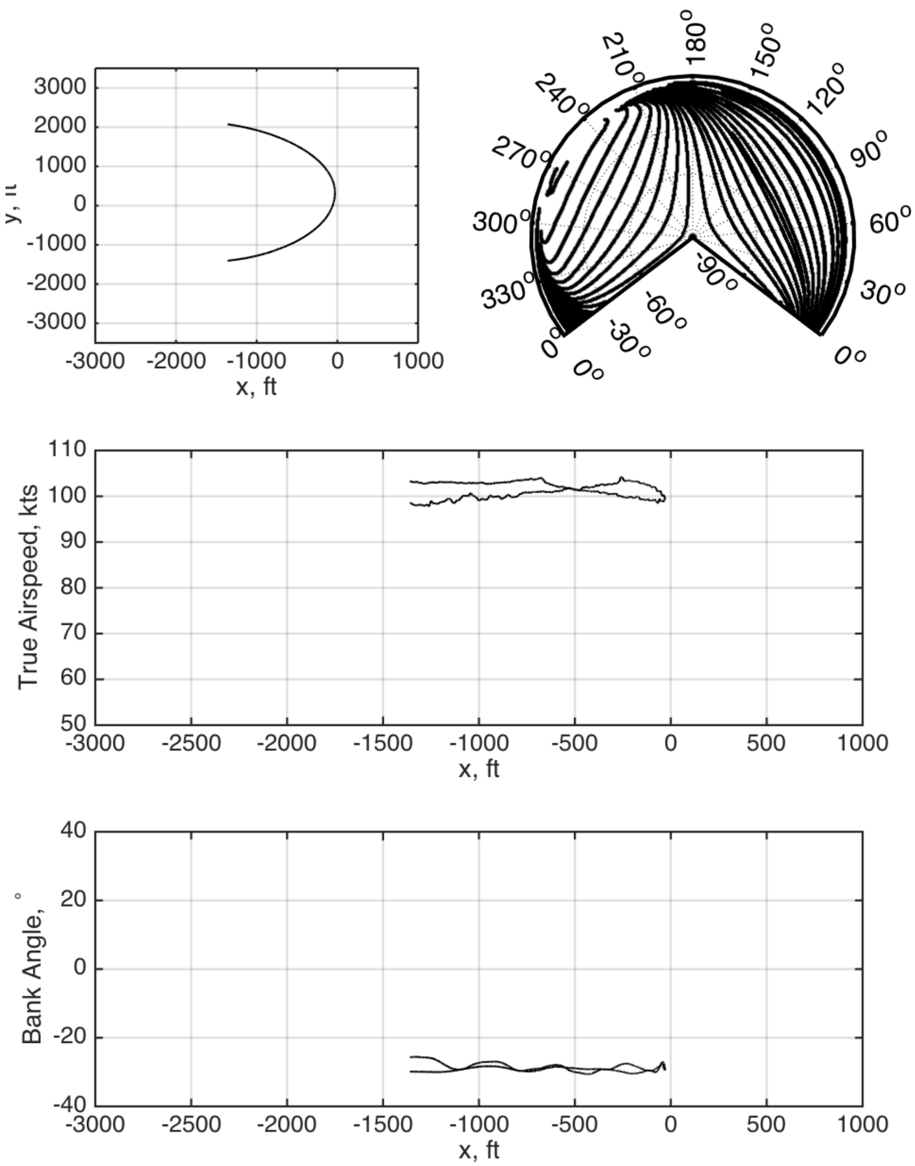


Figure 205: EH-60L S8 test condition, left 30° steady turn, 95 knots, run 318602.

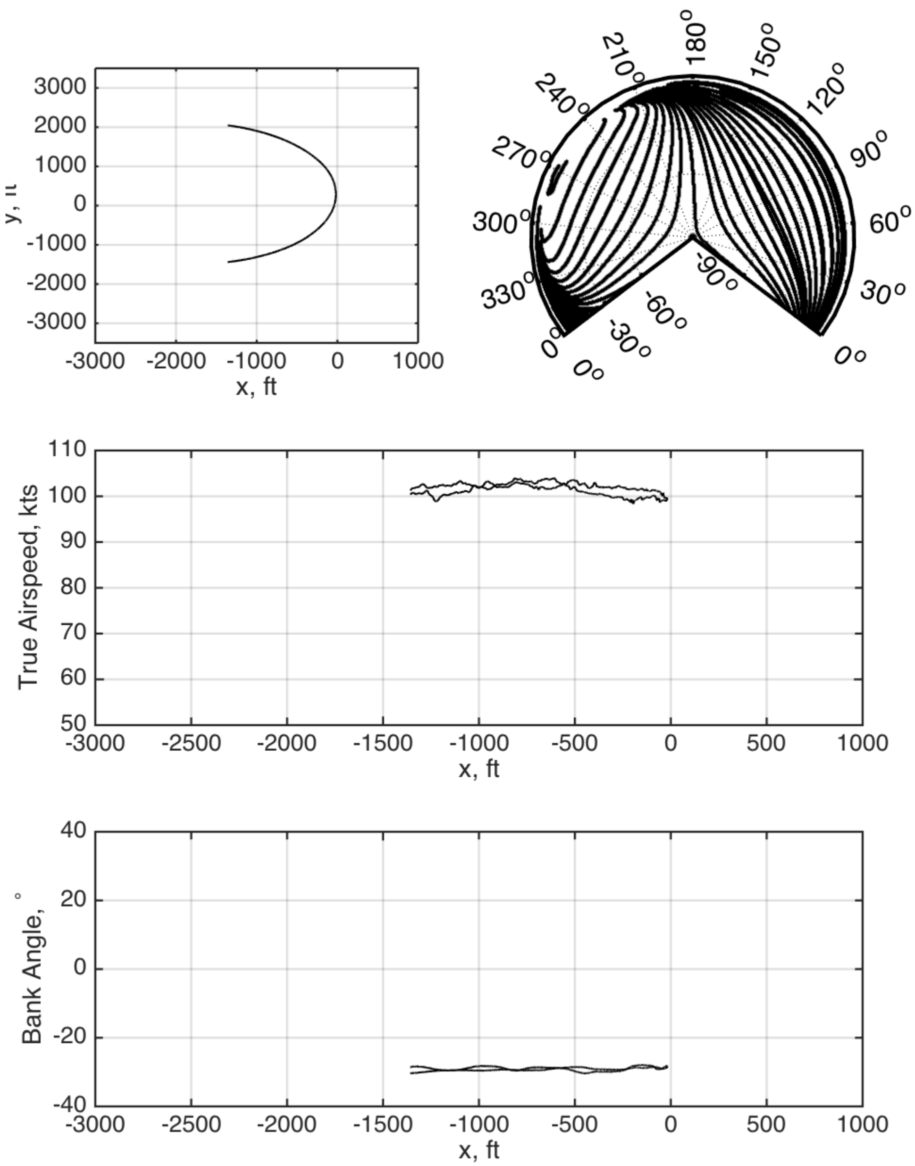


Figure 206: EH-60L S8 test condition, left 30° steady turn, 95 knots, run 318603.

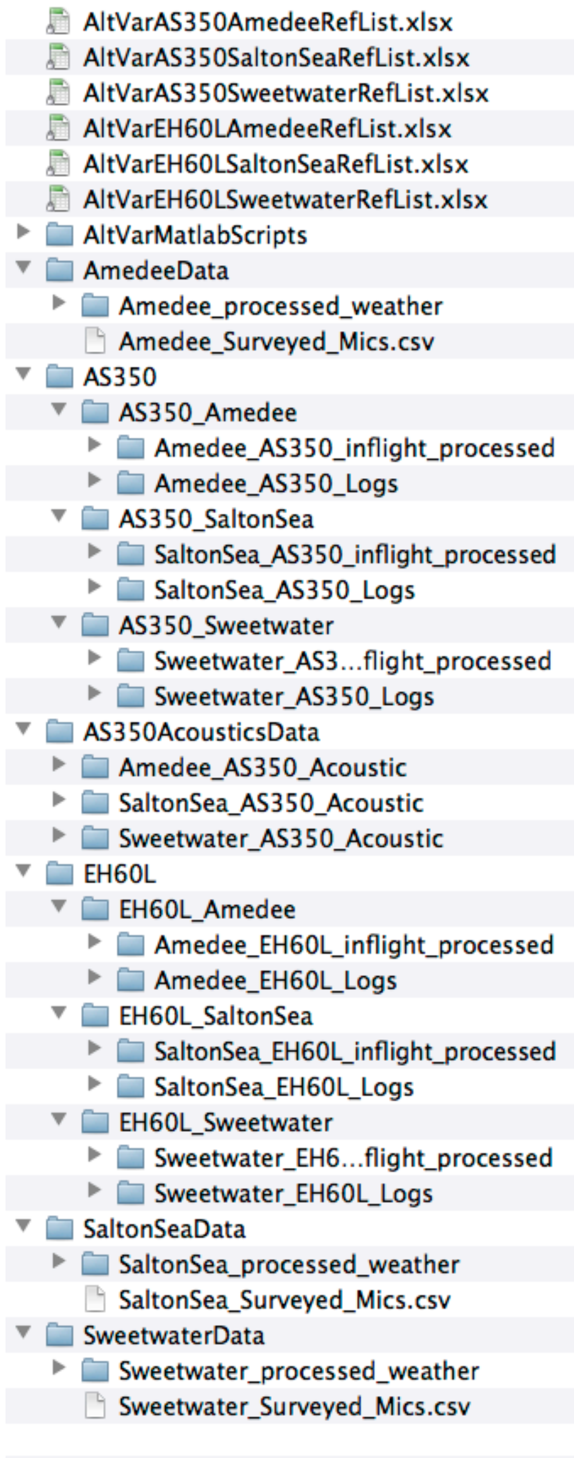


Figure 207: Electronic data file structure.

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14. ABSTRACT
A cooperative flight test campaign between NASA and the U.S. Army was performed from September 2014 to February 2015. The purposes of the testing were to: investigate the effects of altitude variation on noise generation, investigate the effects of gross weight variation on noise generation, establish the statistical variability in acoustic flight testing of helicopters, and characterize the effects of transient maneuvers on radiated noise for a medium-lift utility helicopter. This test was performed at three test sites (0, 4000, and 7000 feet above mean sea level) with two aircraft (AS350 SD1 and EH-60L) tested at each site. This report provides an overview of the test, documents the data acquired and describes the formats of the stored data.

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