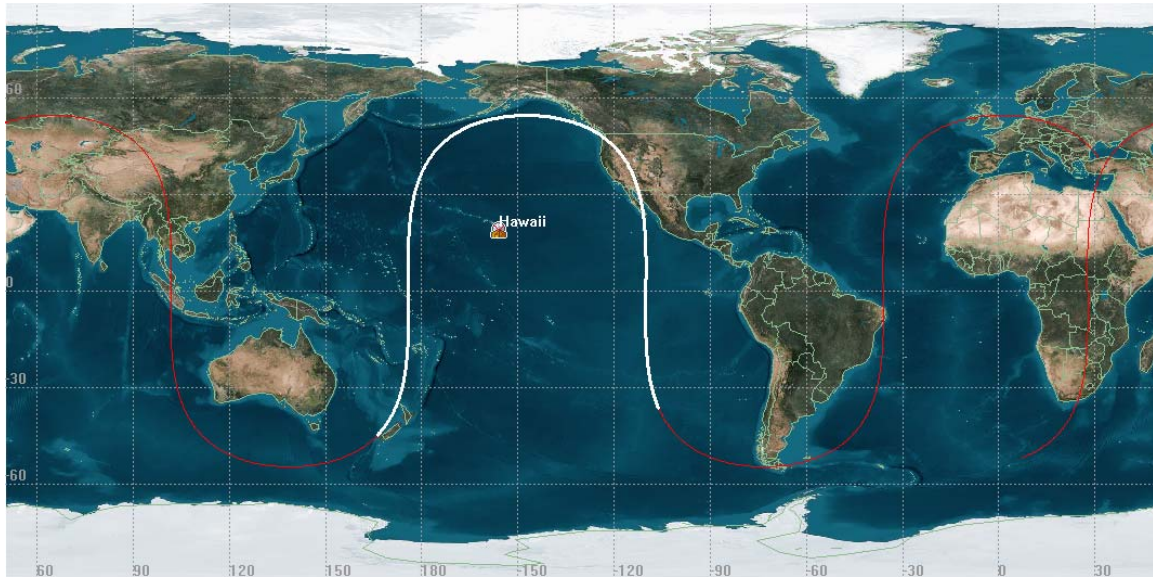


## LEOP support of Galileo (GAL3 and GAL4 aka IOV2) from USN's Hawaii ground station

Galileo is the second launch to orbit the third and fourth satellites of the Galileo navigation constellation for the EU. The second launch consists of 2 spacecraft (GAL3 and GAL4) that will be launched from French Guiana on a Soyuz vehicle on October 10<sup>th</sup>, 2012 at 18:23:06UTC. USN has been contracted to support the Galileo spacecraft LEOP(s) for a period of up to 30 days.

The spacecraft(s) are a Medium Earth Orbiting (MEO) spacecraft in a high mid-latitude orbit (56 degrees) with a near circular orbit of altitude of 23138 Km. This orbit allows a nominal 1 visibility over the USN Hawaii station every day. Each spacecraft contact is on the order of 3 to 15 hours.



GAL3 and GAL4 nominal orbit and Hawaii coverage

The spacecrafts will be supported from injection and six subsequent orbital maneuvers for spacing of GAL3 and GAL4. The below analysis covers all possible visibilities from USN Hawaii, but not all visibilities will be supported.

## GAL3 and GAL4 injection and coverage of pass #1-3

Both spacecraft are still in same antenna beamwidth after injection for the first pass and supported by selecting different RF frequencies. Both downlinks will be supported simultaneously during pass #1, then subsequent passes the spacecraft(s) begins to separate and are supported separately. Post maneuver TLE's and maximum visibilities are shown below for each event and each spacecraft.

	Downlink	Uplink
GAL1	2215.817 MHz	2040.399 MHz
GAL2	2221.955 MHz	2046.051 MHz

### GALILEO-inj

1 12345U 12901A 12284.92787384 +.00000000 +00000-9 +73171-3 2 00002  
2 12345 055.3468 239.6483 0005301 244.4583 355.8400 01.70369259000004

Access	Start Time (UTCG)	Stop Time (UTCG)
1	11 Oct 2012 00:38:27	11 Oct 2012 11:50:34
2	12 Oct 2012 09:26:06	12 Oct 2012 17:12:03
3	12 Oct 2012 19:35:04	13 Oct 2012 00:32:45

## GAL3 Maneuvers and possible support times pass #4 - 34

### GAL3-maneuver #1

1 12345U 12901A 12287.51799769 +.00000000 +00000-9 +73377-3 2 00008  
 2 12345 055.3397 239.5725 0034538 214.3864 174.5479 01.71139495000005

Access	Start Time (UTCG)	Stop Time (UTCG)
4	13 Oct 2012 22:36:53	14 Oct 2012 08:53:33

### GAL3-maneuver #2

1 12345U 12901A 12288.46224537 +.00000000 +00000-9 +73418-3 2 00005  
 2 12345 055.3443 239.5645 0032689 212.1620 038.5271 01.71195774000000

Access	Start Time (UTCG)	Stop Time (UTCG)
5	15 Oct 2012 05:05:58	15 Oct 2012 13:46:00

Note that spacecraft stays in view of Hawaii during the maneuver #3 below, therefore this continues to be pass #5.

### GAL3-maneuver #3

1 12345U 12901A 12289.57401620 +.00000000 +00000-9 +73422-3 2 00003  
 2 12345 055.3439 239.5330 0031970 211.9840 003.9090 01.71210949000006

Access	Start Time (UTCG)	Stop Time (UTCG)
5	15 Oct 2012 13:46:00.000	15 Oct 2012 15:07:21.842
6	16 Oct 2012 13:09:14.599	16 Oct 2012 17:54:54.974
7	16 Oct 2012 20:24:40.934	17 Oct 2012 04:09:24.471
8	18 Oct 2012 01:34:40.076	18 Oct 2012 12:42:45.809
9	19 Oct 2012 10:21:34.817	19 Oct 2012 17:28:26.132
10	19 Oct 2012 19:01:14.633	20 Oct 2012 01:12:14.411
11	20 Oct 2012 23:00:50.713	21 Oct 2012 09:52:17.098
12	22 Oct 2012 06:46:07.942	22 Oct 2012 15:28:21.922
13	22 Oct 2012 19:20:49.811	22 Oct 2012 22:18:27.488
14	23 Oct 2012 13:46:48.420	23 Oct 2012 17:08:54.669
15	23 Oct 2012 20:42:36.721	24 Oct 2012 05:09:12.905
16	25 Oct 2012 02:12:24.777	25 Oct 2012 13:08:54.776
17	26 Oct 2012 10:55:48.278	26 Oct 2012 17:20:29.928
18	26 Oct 2012 18:47:19.311	27 Oct 2012 01:45:49.844
19	27 Oct 2012 23:26:18.552	28 Oct 2012 10:32:35.399
20	29 Oct 2012 07:54:22.112	29 Oct 2012 15:47:02.979
21	29 Oct 2012 18:31:42.293	29 Oct 2012 22:58:17.880
22	30 Oct 2012 14:45:28.108	30 Oct 2012 15:59:17.311
23	30 Oct 2012 21:03:08.711	31 Oct 2012 06:46:31.213
24	1 Nov 2012 03:04:36.853	1 Nov 2012 13:32:45.328
25	2 Nov 2012 11:28:48.350	2 Nov 2012 16:51:26.001
26	2 Nov 2012 18:54:04.424	3 Nov 2012 02:23:35.815
27	3 Nov 2012 23:55:04.099	4 Nov 2012 11:04:57.362

28	5 Nov 2012 08:39:13.204	5 Nov 2012 16:01:34.796
29	5 Nov 2012 17:53:07.985	5 Nov 2012 23:32:16.774
30	6 Nov 2012 21:25:30.065	7 Nov 2012 08:02:43.397
31	8 Nov 2012 04:31:12.417	8 Nov 2012 13:54:41.023
32	8 Nov 2012 18:31:11.626	8 Nov 2012 20:27:17.971
33	9 Nov 2012 12:03:30.443	9 Nov 2012 16:10:34.751
34	9 Nov 2012 19:09:50.246	10 Nov 2012 03:11:54.712

## GAL4 Maneuvers and possible support times pass #4 - 34

### GAL4-maneuver #1

1 12346U 12901B 12287.17942130 +.00000000 +00000-9 +73303-3 2 00001  
2 12346 055.3407 239.5853 0020263 008.6391 174.2603 01.71037119000004

Access	Start Time (UTCG)	Stop Time (UTCG)
4	13 Oct 2012 22:30:25	14 Oct 2012 03:57:00

Note that spacecraft stays in view of Hawaii during the maneuver #2 below, therefore this continues to be pass #4.

### GAL4-maneuver #2

1 12346U 12901B 12288.16496528 +.00000000 +00000-9 +73446-3 2 00004  
2 12346 055.3450 239.5745 0020302 311.0626 118.6759 01.71539918000006

Access	Start Time (UTCG)	Stop Time (UTCG)
4	14 Oct 2012 03:57:00	14 Oct 2012 08:38:20
5	15 Oct 2012 04:43:51	15 Oct 2012 05:36:00

Note that spacecraft stays in view of Hawaii during the maneuver #3 below, therefore this continues to be pass #5.

### GAL4-maneuver #3

1 12346U 12901B 12289.23372685 +.00000000 +00000-9 +73477-3 2 00004  
2 12346 055.3447 239.5440 0018520 299.6434 070.1166 01.71652285000008

Access	Start Time (UTCG)	Stop Time (UTCG)
5	15 Oct 2012 05:36:00.000	15 Oct 2012 14:55:12.783
6	16 Oct 2012 12:48:56.463	16 Oct 2012 17:58:34.428
7	16 Oct 2012 20:09:39.423	17 Oct 2012 03:41:12.409
8	18 Oct 2012 01:06:52.560	18 Oct 2012 12:14:06.975
9	19 Oct 2012 09:42:50.891	19 Oct 2012 17:06:10.154
10	19 Oct 2012 19:02:42.786	20 Oct 2012 00:32:47.164
11	20 Oct 2012 22:23:29.291	21 Oct 2012 08:48:50.608
12	22 Oct 2012 04:57:14.970	22 Oct 2012 14:45:16.735
13	22 Oct 2012 20:16:47.549	22 Oct 2012 20:41:06.176
14	23 Oct 2012 12:43:23.053	23 Oct 2012 17:26:13.467
15	23 Oct 2012 19:57:09.037	24 Oct 2012 03:39:34.510
16	25 Oct 2012 01:00:31.015	25 Oct 2012 12:06:37.474
17	26 Oct 2012 09:38:48.532	26 Oct 2012 16:51:38.480
18	26 Oct 2012 18:32:56.973	27 Oct 2012 00:26:43.824
19	27 Oct 2012 22:13:55.459	28 Oct 2012 08:52:28.766
20	29 Oct 2012 05:16:25.295	29 Oct 2012 14:35:02.301
21	29 Oct 2012 19:12:48.529	29 Oct 2012 21:04:53.324
22	30 Oct 2012 12:38:21.237	30 Oct 2012 16:52:30.579

23	30 Oct 2012	19:45:24.640	31 Oct 2012	03:40:06.587
24	1 Nov 2012	00:55:04.984	1 Nov 2012	11:58:44.962
25	2 Nov 2012	09:34:08.227	2 Nov 2012	16:35:13.036
26	2 Nov 2012	18:05:23.547	3 Nov 2012	00:20:48.575
27	3 Nov 2012	22:04:45.511	4 Nov 2012	08:53:05.024
28	5 Nov 2012	05:35:55.399	5 Nov 2012	14:24:40.634
29	5 Nov 2012	18:29:24.112	5 Nov 2012	21:08:21.174
30	6 Nov 2012	12:34:14.663	6 Nov 2012	16:17:33.169
31	6 Nov 2012	19:34:04.868	7 Nov 2012	03:43:49.977
32	8 Nov 2012	00:50:38.539	8 Nov 2012	11:50:24.660
33	9 Nov 2012	09:28:46.758	9 Nov 2012	16:16:10.633
34	9 Nov 2012	17:40:28.298	10 Nov 2012	00:14:52.681