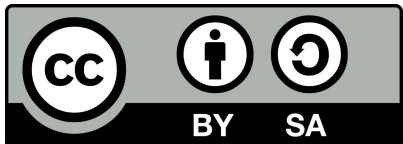
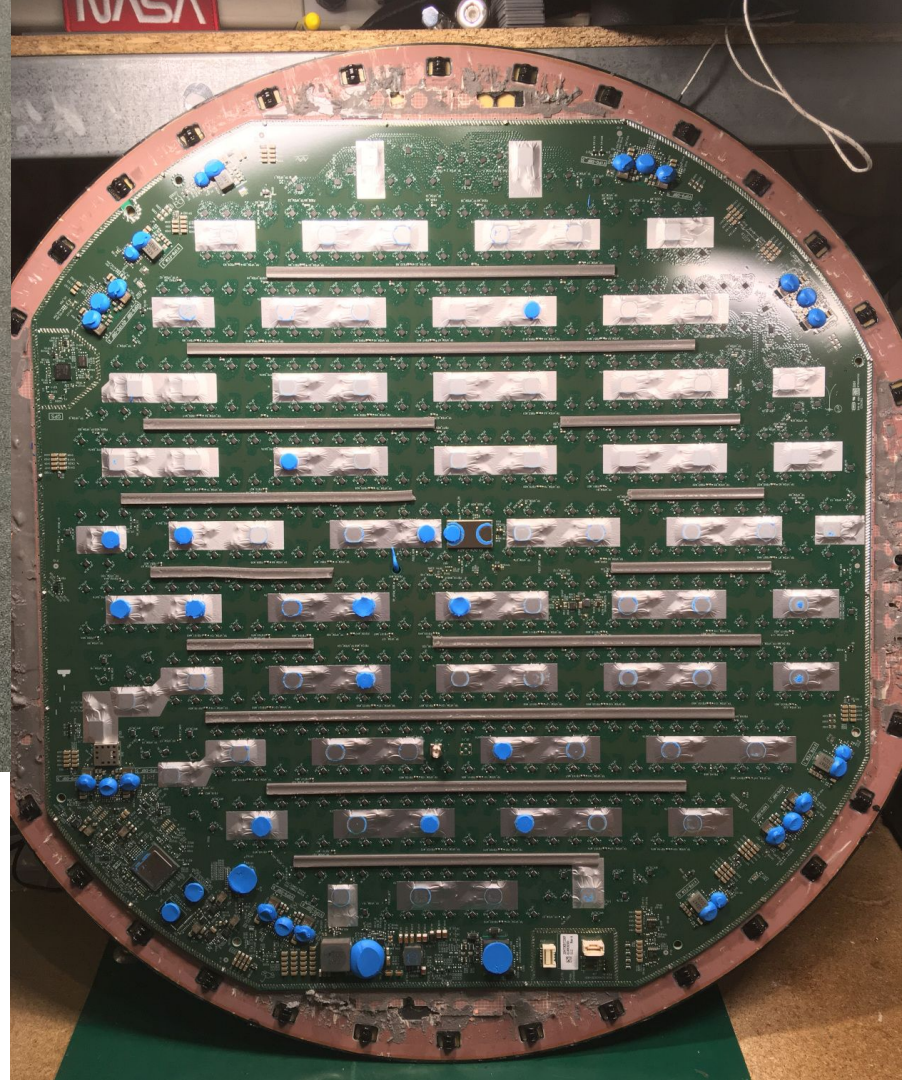


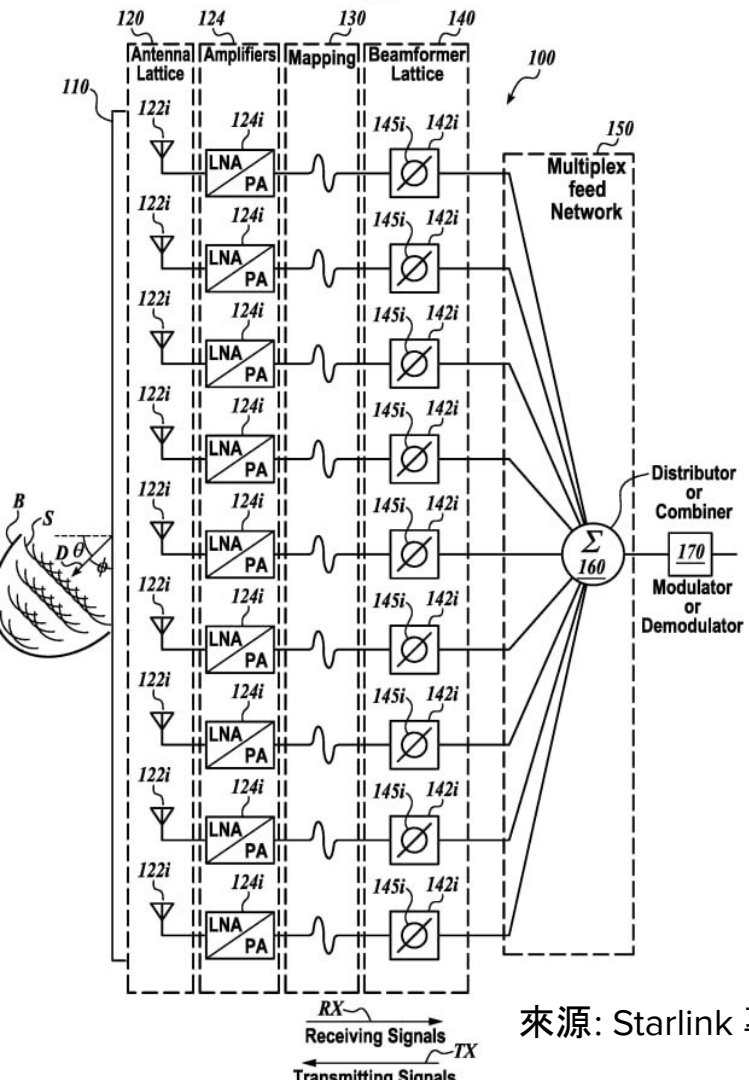
衛星通訊的資安觀點

Philippe Lin (BU2FS) / 2022.10.21





神人必追: @olegkutkov



來源: Starlink 專利申請書



黃彥銘博士 相控陣列雷達課程

太高級的先不要玩
一步一步來...



Inmarsat IsatPhone 2



Iridium Extreme 9575



Thuraya X5-TOUCH



Globalstar GSP-1700

Price	\$599.00	\$1295.00	\$1229.00	\$495
Network	Inmarsat	Iridium	Thuraya	Globalstar
Coverage				
Battery	8h Talk/160h stand by	4h Talk/30h Stand by	9h Talk/160h stand by	4h Talk/36h stand by
SOS	✓	✓	✓	X
GPS	✓	✓	✓	✓
Size	6.7"H - 3"W	5.5"H - 2.3"W	5.7"H - 3"W	5.3"H - 1.3"W

忘了從哪家代理商的網頁找到的 QQ 類似的請參考 <https://www.satphonestore.com/about-satellite-comms>

デシベルミリワット

33.5

dBm

変換後

ワット

2.239

W

dBm〜ワット変換の式

$$P(W) = 1W \times \frac{10^{\frac{P(dBm)}{10}}}{1000} = 10^{\frac{P(dBm) - 30}{10}}$$

通常這類的語音都是沒加密的，在戰地使用時也容易因為無線電的功率，曝露自己的位置。說是這麼說，發射功率一般都在 5w 以下...

例如: IsatPhone 2 +33.5 dBm, Iridium Extreme +32.7 dBm

參考: <https://fccid.io/Q639575N/RF-Exposure-Info/TUV-SAR-report-part1-3463553>



Quality



THURAYA



MARICHEM
WORLDWIDE



MARIGASES
SERVICES



Partners

Memberships



Bulgaria
Phone: +359 52 683 373
E-mail: info@nbs-maritime.com

Romania
Phone: +40 371 015 121
E-mail: supply.ro@nbs-maritime.com

Turkey
Phone: +90 212 510 1627
E-mail: supply.tr@nbs-supply.com

Netherlands
Phone: +31 164 31 50 30
E-mail: supply.nl@nbs-maritime.com



INFLIGHT WI-FI



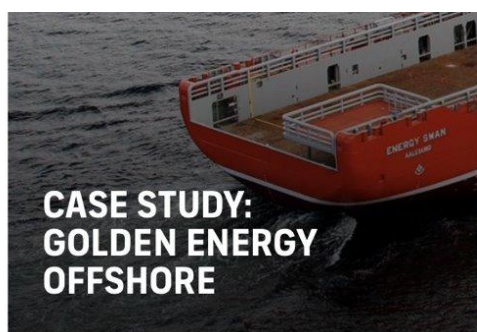
AIRLINE OPERATIONS AND MAINTENANCE



PIPELINE MONITORING



WELLHEAD MONITORING



FACT SHEET



Iridium® Connectivity for the Oil & Gas Industry

Extend Communications in Ways Never Thought Possible

The Iridium Certus® and Iridium® Push-to-Talk services extend communications coverage beyond the reach of terrestrial and cellular infrastructure for oil and gas companies, whether at the job site or while conducting exploratory and surveying work. As the only communications company offering truly global coverage, Iridium's superior combination of satellite voice and data solutions are ideal for supporting critical connectivity needs regardless of location, terrain and weather conditions. With Iridium, oil and gas companies can be confident in knowing they've chosen a communications solution that will work wherever and whenever needed.

取自 Iridium 官網

Iridium CloudConnect

powered by **aws**



COMMAND AND CONTROL
FOR AUTONOMOUS SYSTEMS

(Source: <https://www.nesdis.noaa.gov/content/currently-flying>)

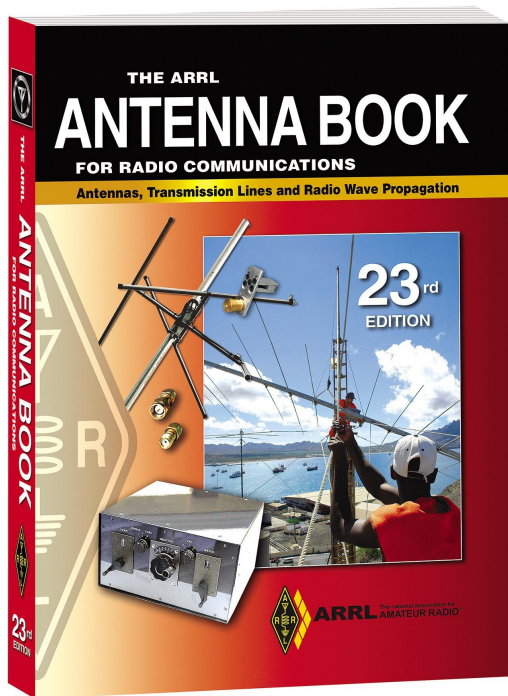
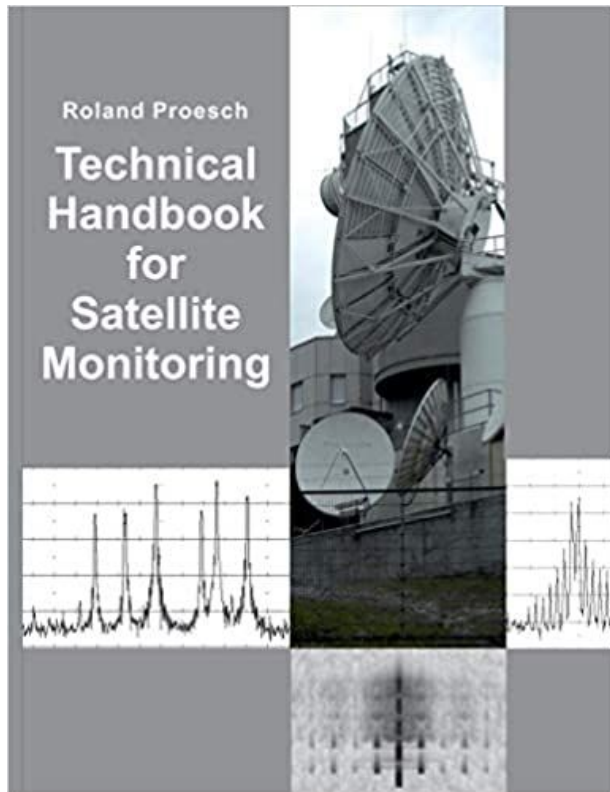




Source: <https://www.cospas-sarsat.int/en/search-and-rescue/system-graphics-en>

接收衛星訊號 & 基礎科學

你需要一些知識



目前到第24版

軌道

TLE

Link budget

太陽磁爆

操作模式 (DVB/SCPC)

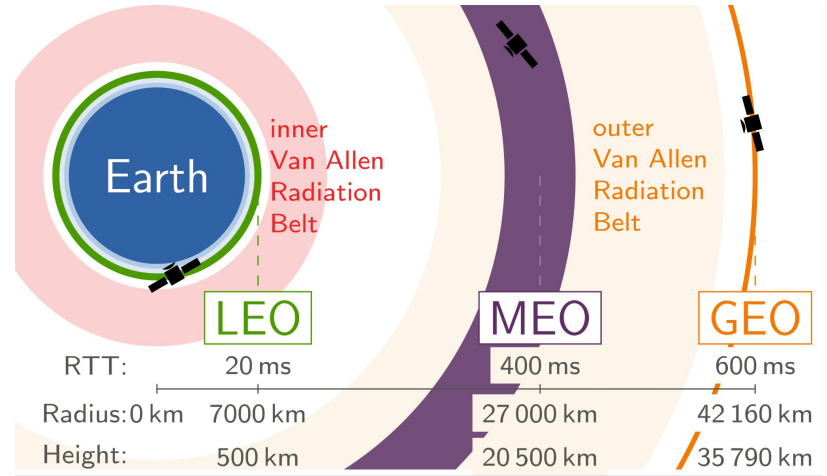
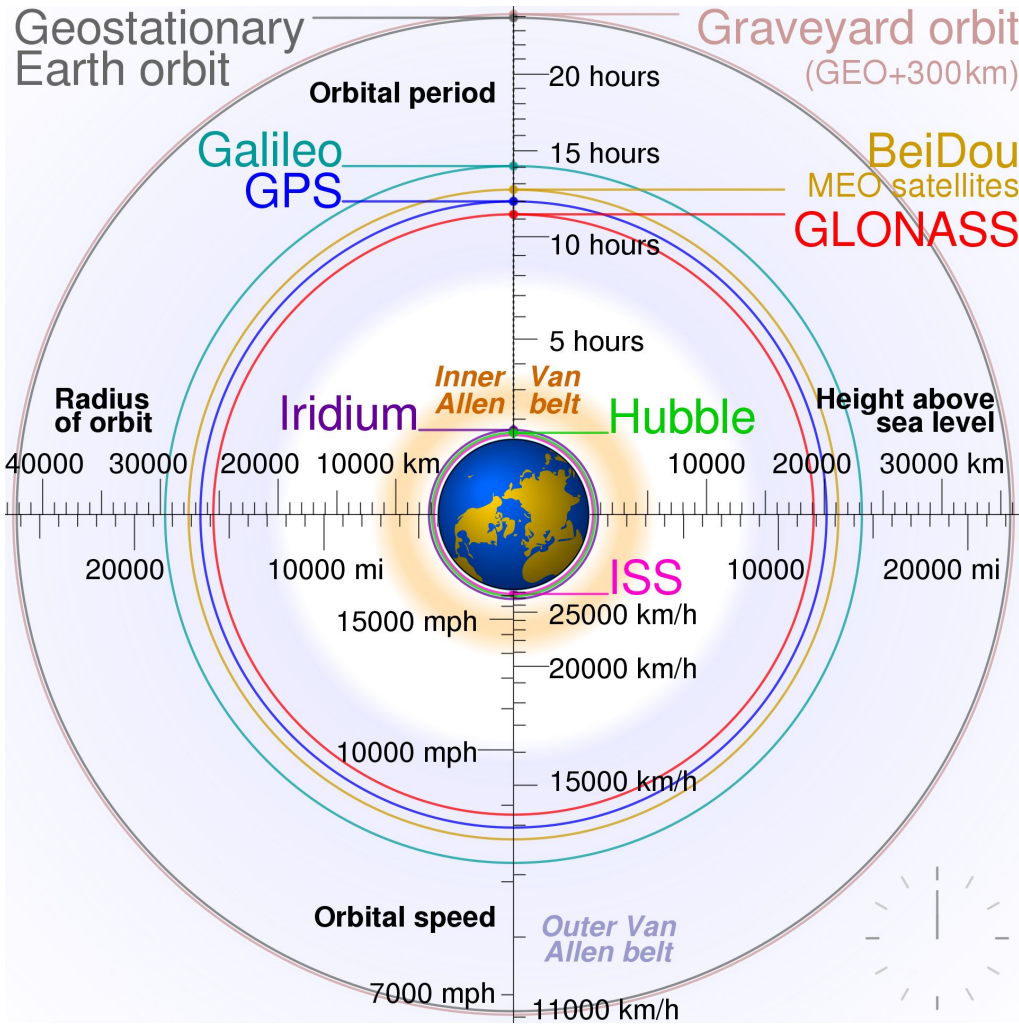
調變

類比

數位

除錯碼

展頻



By Sedrubal - Own work, CC BY-SA 4.0,
<https://commons.wikimedia.org/w/index.php?curid=114587517>

By cmglee - Own work, CC BY-SA 3.0,
<https://commons.wikimedia.org/w/index.php?curid=16891766>

TLE

編號 1998年第67顆發射的第一顆 平均運動1次微分 B* 發佈次數 Chksum

U: 無密等

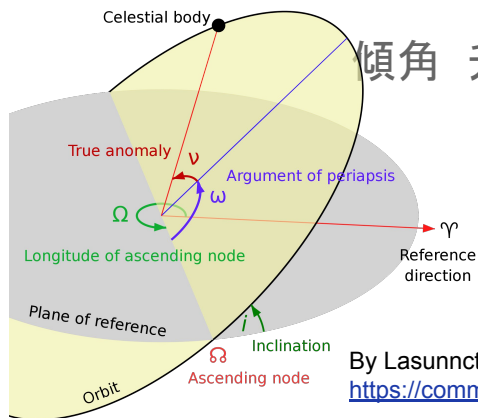
2008/第264.5天

平均運動2次微分

ISS (ZARYA)

1 25544U 98067A 08264.51782528 -.00002182 00000-0 -11606-4 0 2927
2 25544 51.6416 247.4627 0006703 130.5360 325.0288 15.72125391563537

傾角 升交點黃經 離心率 近心點輻角 平近點角 平均運動 Chksum



By Lasunncty at the English Wikipedia, CC BY-SA 3.0,
<https://commons.wikimedia.org/w/index.php?curid=8971052>

最新的 TLE 從這裡下載
<https://live.ariss.org/tle/>

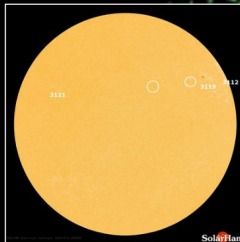
SolarHam

by Amateur Radio Station VE3EN

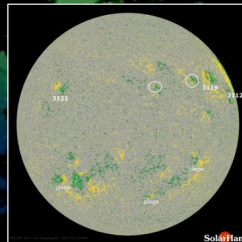


Space Weather for October 15, 2022

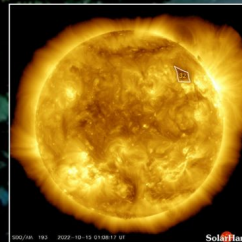
UTC Time 07:03:50 Sunday



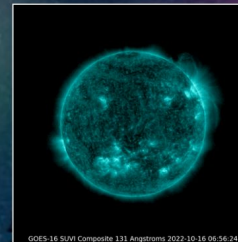
HMI Intensity
[Analysis](#) | [Latest](#) | [Movie](#)



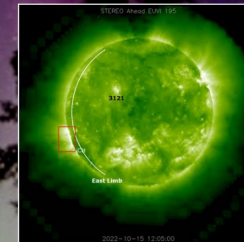
HMI Magnetogram
[Latest](#) | [Movie](#)



Coronal Holes
[Analysis](#) | [Movie](#)



AIA 131 (Latest)
[Movie](#)



STEREO-A (Farside)
[Latest Image](#)

[Latest Imagery: SDO](#) | [AIA](#) | [GOES-16](#) | [GONG](#) | [STEREO](#) | [LASCO](#)

[Video: SDO](#) | [SOHO](#) | [STEREO](#) | [Helioviewer](#) | [YouTube](#)

Solar Indices (Oct. 15 @ 21:05 UTC)

SFI	SSN	AREA
115	51	260
▼ 6	▼ 6	▼ 220

[WWV](#) | [Flux Data](#) | [Last 30 Days](#)

[Cycle 25 Progression](#)

3 Day Geomagnetic Forecast

Oct. 15	Oct. 16	Oct. 17
4 (G0)	2-3 (G0)	2 (G0)

Max Kp

Data provided by NOAA/SWPC

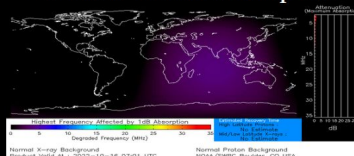
Solar Flare Detection

[Click to expand data](#)



X-Rays
85.2
Current
Solar Demon
Solar SOFT

Global D-LAYER Absorption

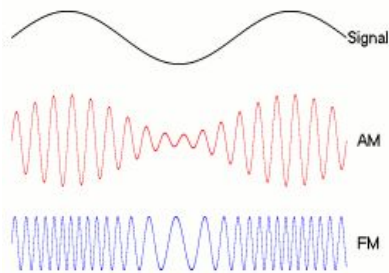


Current Solar Flare Threat

C-Flare: 35%	M-Flare: 05%
X-Flare: 01%	Proton: 05%

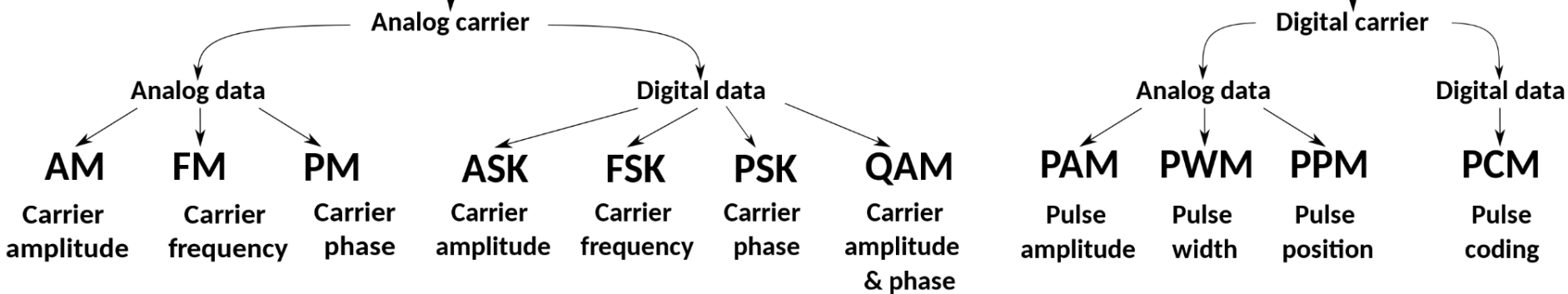
[Probability Details](#)

調變



右邊不用看

Modulation



Modulation chart by Michel Bakni - Own work, CC BY-SA 4.0, <https://commons.wikimedia.org/w/index.php?curid=109678259>

GIF animation by Berserkerus - Own work, CC BY-SA 2.5, <https://commons.wikimedia.org/w/index.php?curid=5071748>

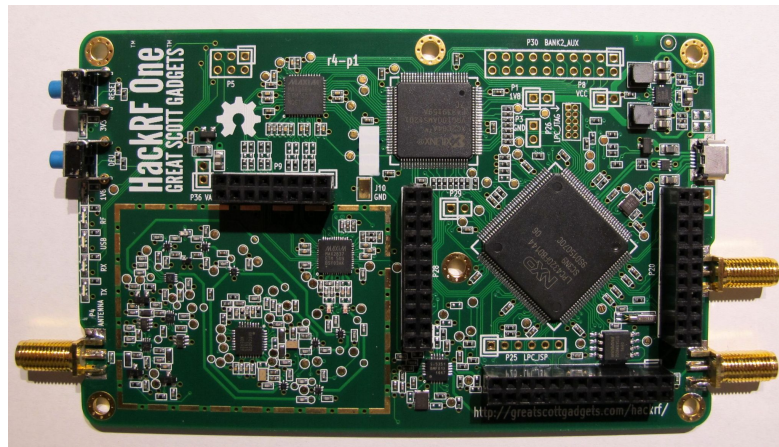
你需要一些裝備



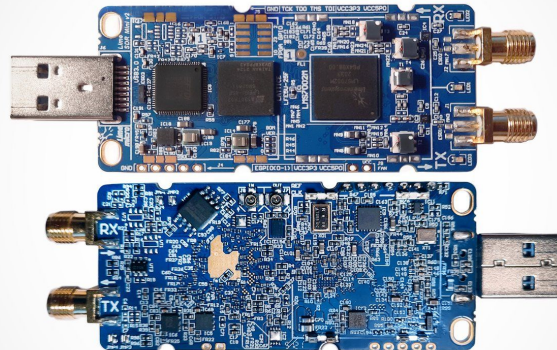
RTL-SDR v3 (去 eBay 買)



BladeRF (nuand.com)



By wdwd - Own work, CC BY-SA 4.0,
<https://commons.wikimedia.org/w/index.php?curid=44357696>



LimeSDR Mini 2.0
(募資中)

ISS

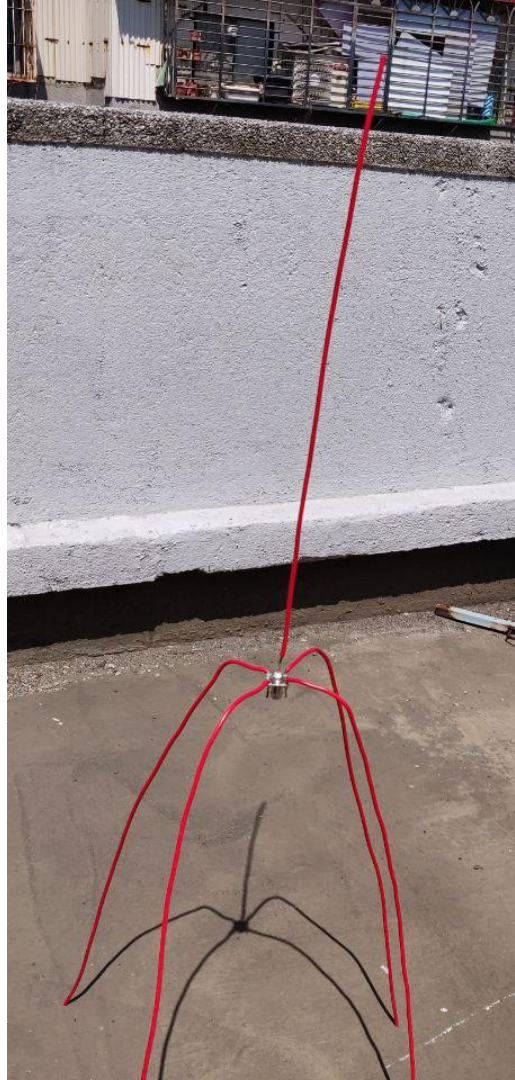
詳見:

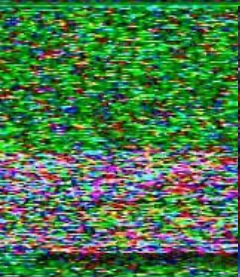
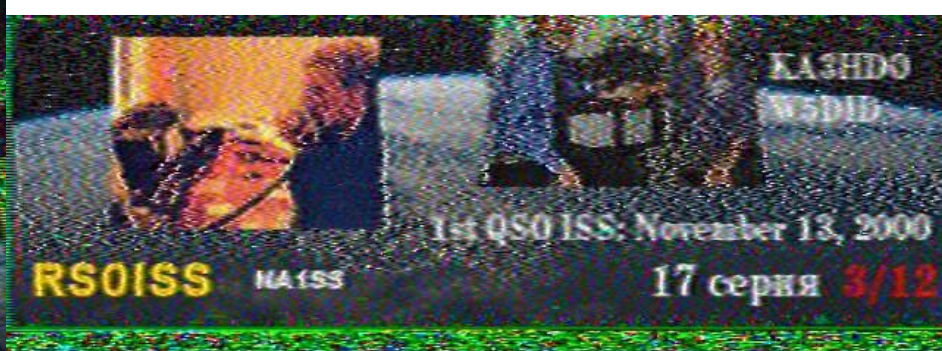
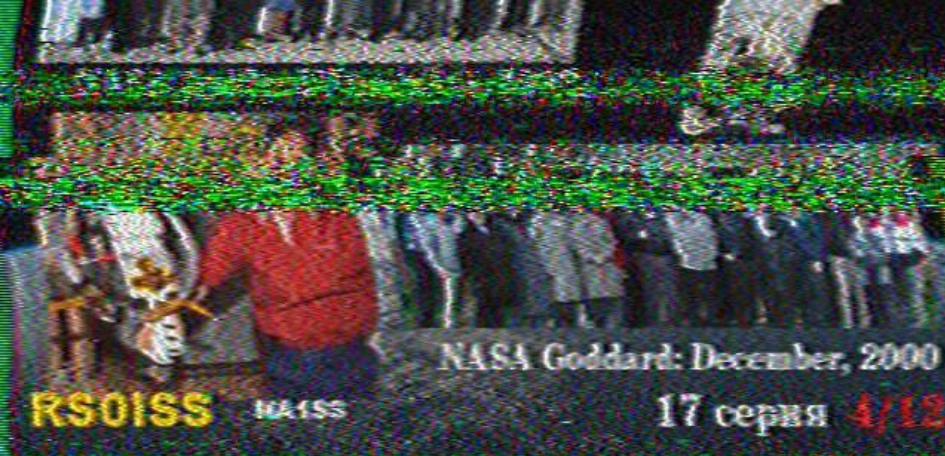
<https://www.rtl-sdr.com/international-space-station-sstv-event-scheduled-for-october-9-and-10/>

SSTV 慢速掃描電視, 145.800 MHz

FM, 3 KHz, 用~~寶鋒~~都收得到

接收地點不良的話, 可以用 <http://www.websdr.org/>







美國氣象衛星, NOAA-15, -18, -19

APT 協議, 38 kHz 類比

137.620 / 137.9125 / 137.100 MHz

RHCP (右旋圓極化)

GP (-3 dB) 或 V-pole (-3 dB) 或 QFH 天線

BU2FS's Orbit Calendar For NOAA-15									
Date	Time	El	Az	Phase	LatN	LonW	Range	Orbit	
Sun 090ct22	22:55:31	0	44	110	43	213	3327	27030	*
Sun 090ct22	22:57:10	4	54	114	37	215	2882	27030	*
Sun 090ct22	22:58:49	8	67	118	31	216	2533	27031	*
Sun 090ct22	23:00:27	11	84	122	26	218	2330	27031	*
Sun 090ct22	23:02:04	11	103	126	20	219	2310	27031	*
Sun 090ct22	23:03:41	9	120	130	14	221	2475	27031	*
Sun 090ct22	23:05:19	5	134	134	8	222	2796	27031	*
Sun 090ct22	23:06:57	1	145	139	3	223	3226	27031	*
Sun 090ct22	23:07:17	0	146	139	1	224	3321	27031	*
Mon 100ct22	00:33:47	0	6	103	52	234	3327	27031	*
Mon 100ct22	00:35:26	7	4	107	47	236	2676	27031	*
Mon 100ct22	00:37:04	15	360	111	41	239	2047	27031	*
Mon 100ct22	00:38:40	28	351	115	35	240	1484	27032	*
Mon 100ct22	00:40:08	46	330	119	30	242	1085	27032	*
Mon 100ct22	00:41:18	56	286	122	26	243	959	27032	*
Mon 100ct22	00:42:15	49	247	124	23	244	1037	27032	*
Mon 100ct22	00:43:21	35	226	127	19	245	1289	27032	*
More? [y/n] >>									

你需要 KD2BD 寫的 Predict

不一定需要知道

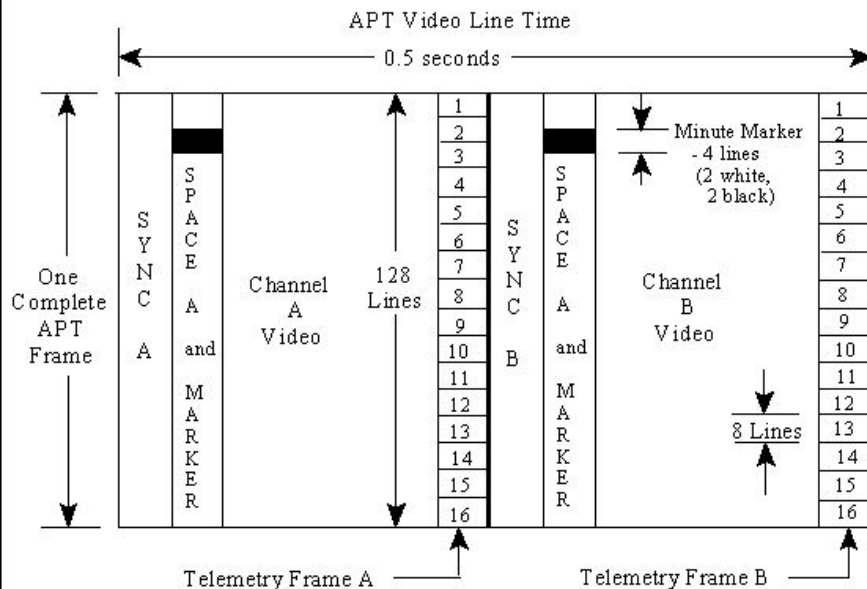
4160 baud, A / B 畫面

每 frame = 128 條 (84秒)

每條 909 像素 + sync + mark

類比 (!)

Figure 4.2.2-1. APT Frame Format.

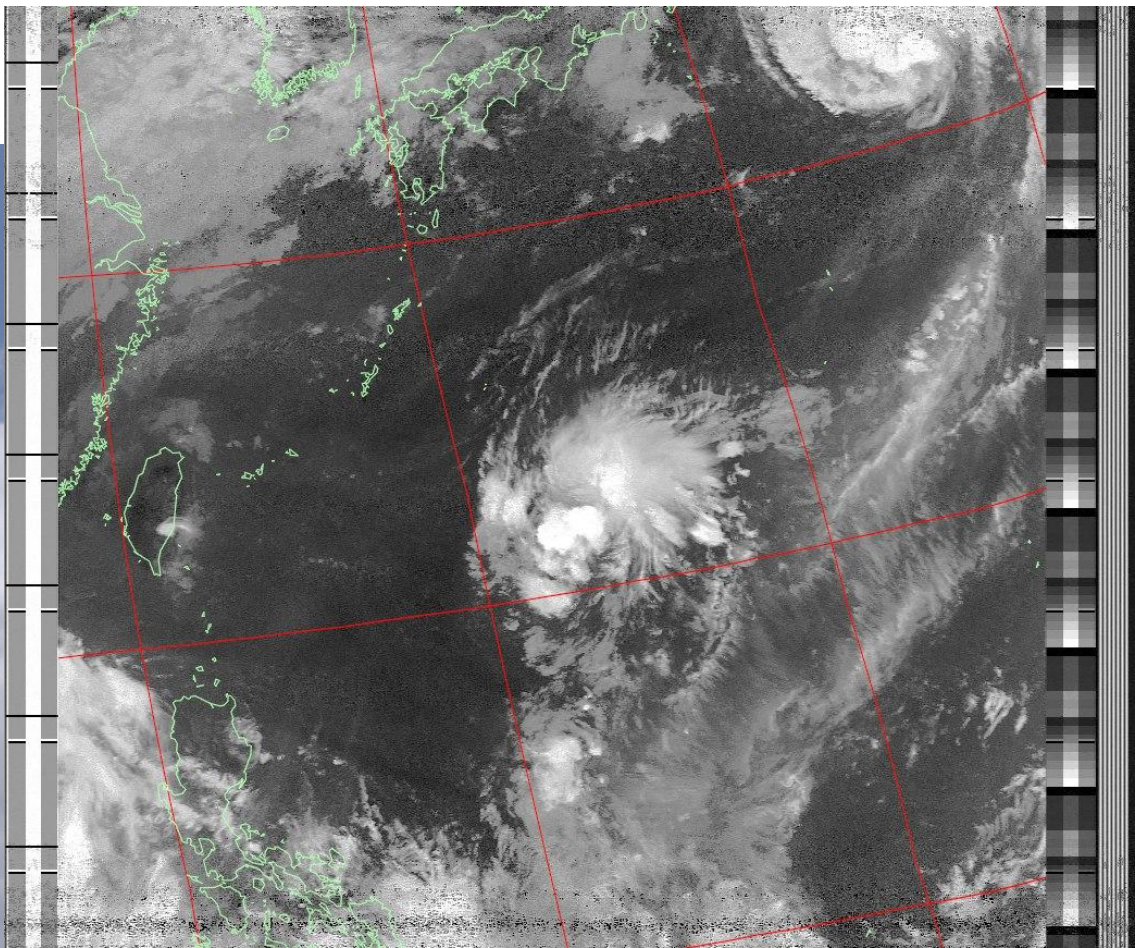


WEDGE #1	WEDGE #2	WEDGE #3	WEDGE #4	WEDGE #5	WEDGE #6	WEDGE #7	WEDGE #8
1	2	3	4	5	6	7	8
Zero Modulation Reference	Thermistor Temp. #1	Thermistor Temp. #2	Thermistor Temp. #3	Thermistor Temp. #4	Patch Temp.	Back Scan	Channel I.D. Wedge
9	10	11	12	13	14	15	16

Notes:

- 1) Each telemetry frames consists of 16 points
- 2) Telemetry frame rate is 1 frame per 84 seconds
- 3) Each telemetry point is repeated on 8 successive APT video lines

你可以土炮 **QFH** 天線



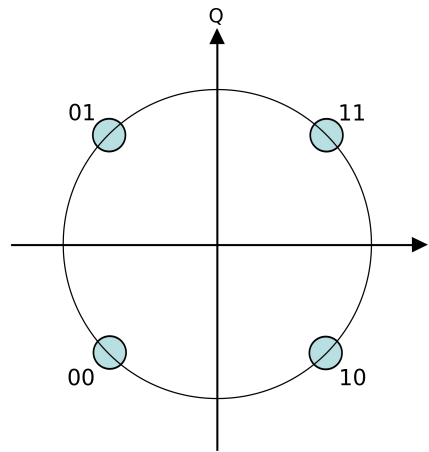
Meteor M2

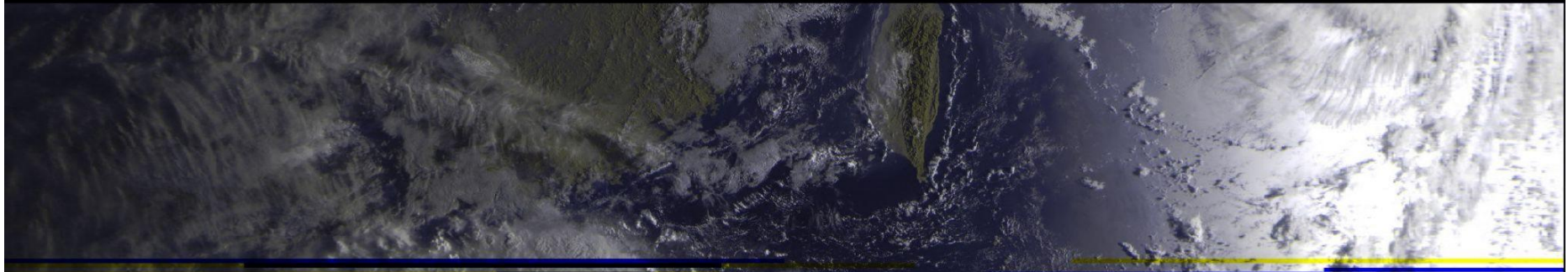
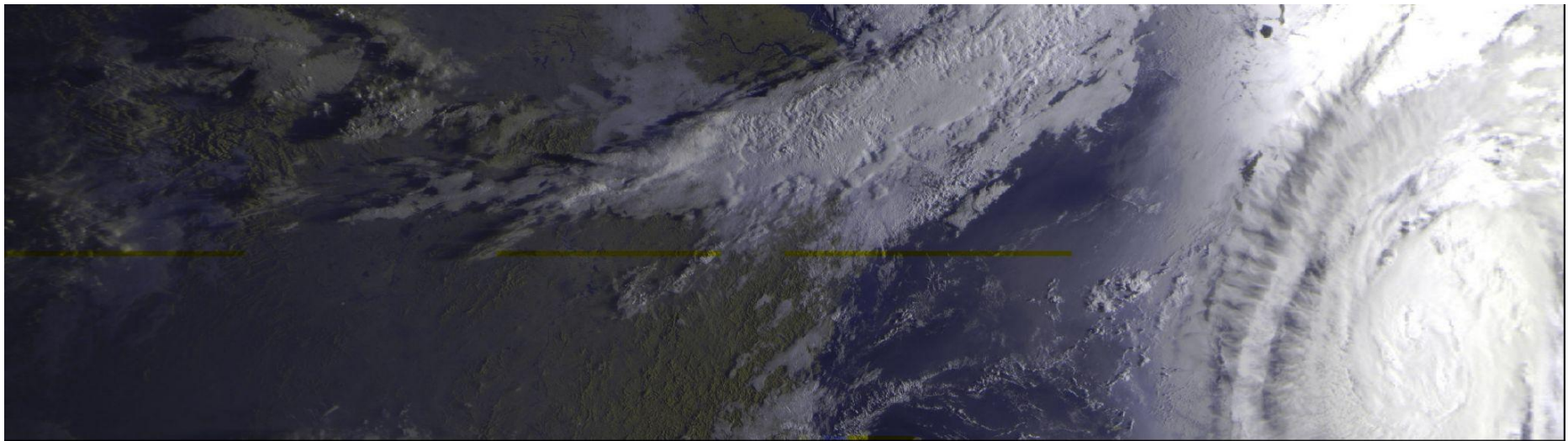
俄國氣象衛星 (2014)

LRPT 低速圖傳, 120 kHz, 數位, 72 kBd QPSK $\rightarrow$ 144 kbps

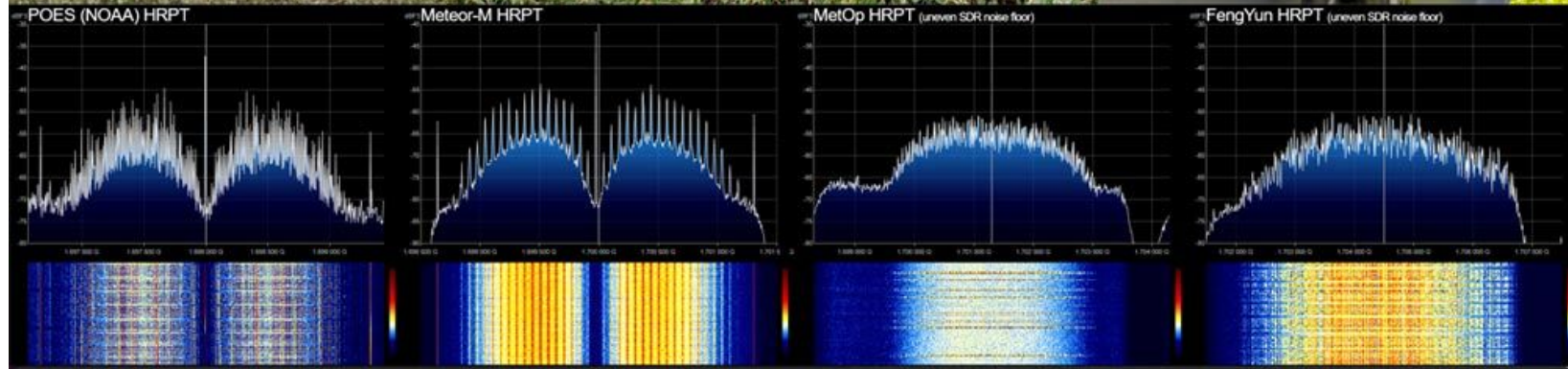
1 km/pixel

每秒6行、每行2048像素、每像素 10-bits $\rightarrow$ AVHRR 格式





2560x1382



要收高頻的話
可以參考：
OK9SGC
Derek

Iridium

66顆邏輯衛星

(目前)唯一具有星間鏈路

第一批 1997-2002 發射95顆衛星

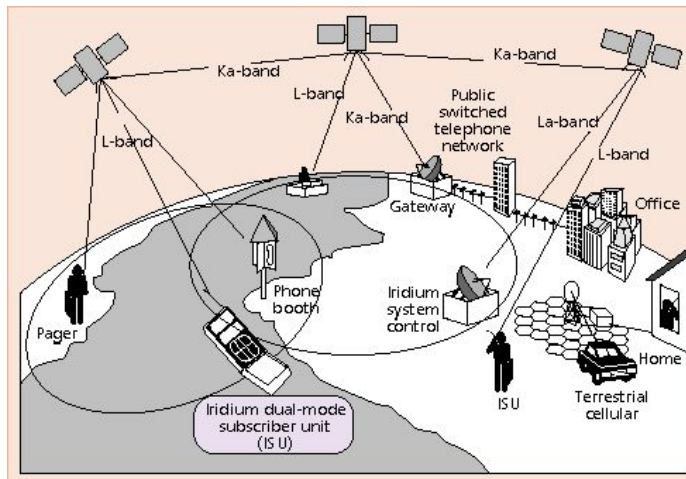
第二批 2017-2019 發射75顆 Iridium NEXT

1616 - 1626.5 MHz, TDMA + FDMA

QPSK (下行) BPSK (上行)

波束、240 channels、sub-channel ...

可以用 GPS 天線或是土炮鐵板天線 ...



<https://www.everythingrf.com/community/what-frequency-does-the-iridium-satellite-system-use>



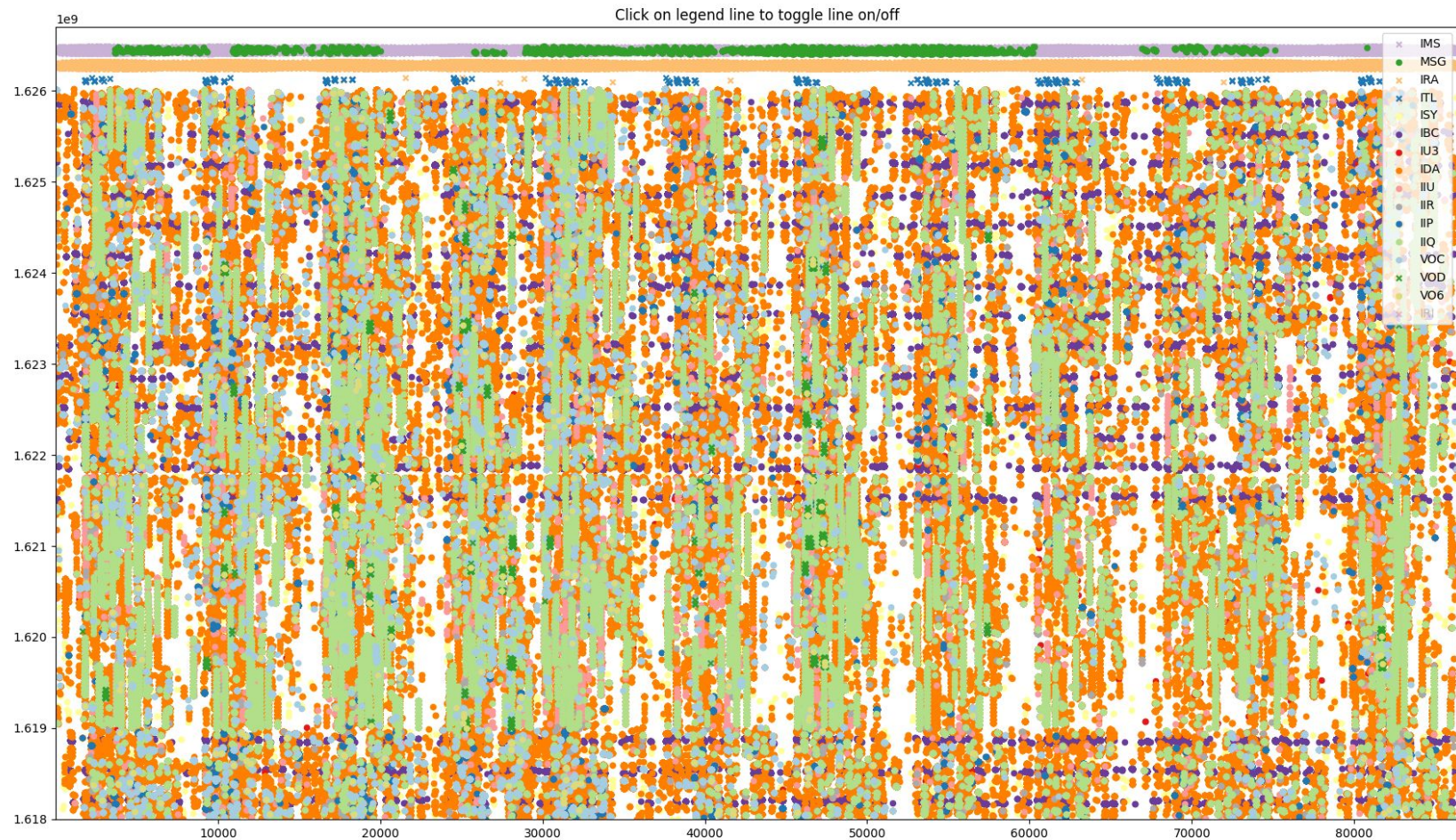
<https://www.youtube.com/watch?v=luVPpzopmrY>



加上 muCCC 大神們的程式就可以了 <https://github.com/muccc/gr-iridium>

1665335586	i: 132/s i_avg: 218/s q_max: 8 i_ok: 72% o: 280/s ok: 75% ok: 100/s ok_avg: 63% ok: 8661350 ok_avg: 139/s d: 0
1665335587	i: 174/s i_avg: 218/s q_max: 10 i_ok: 65% o: 415/s ok: 67% ok: 117/s ok_avg: 63% ok: 8661468 ok_avg: 139/s d: 0
1665335588	i: 207/s i_avg: 218/s q_max: 9 i_ok: 64% o: 449/s ok: 65% ok: 136/s ok_avg: 63% ok: 8661605 ok_avg: 139/s d: 0
1665335589	i: 178/s i_avg: 218/s q_max: 8 i_ok: 72% o: 407/s ok: 72% ok: 129/s ok_avg: 63% ok: 8661735 ok_avg: 139/s d: 0
1665335590	i: 195/s i_avg: 218/s q_max: 9 i_ok: 52% o: 431/s ok: 54% ok: 105/s ok_avg: 63% ok: 8661841 ok_avg: 139/s d: 0
1665335591	i: 171/s i_avg: 218/s q_max: 7 i_ok: 51% o: 381/s ok: 53% ok: 91/s ok_avg: 63% ok: 8661933 ok_avg: 139/s d: 0
1665335592	i: 163/s i_avg: 218/s q_max: 9 i_ok: 61% o: 365/s ok: 64% ok: 105/s ok_avg: 63% ok: 8662039 ok_avg: 139/s d: 0
1665335593	i: 124/s i_avg: 218/s q_max: 5 i_ok: 67% o: 281/s ok: 70% ok: 87/s ok_avg: 63% ok: 8662127 ok_avg: 139/s d: 0
1665335594	i: 124/s i_avg: 218/s q_max: 7 i_ok: 68% o: 274/s ok: 71% ok: 88/s ok_avg: 63% ok: 8662216 ok_avg: 139/s d: 0
1665335595	i: 105/s i_avg: 218/s q_max: 6 i_ok: 65% o: 240/s ok: 66% ok: 70/s ok_avg: 63% ok: 8662287 ok_avg: 139/s d: 0
1665335596	i: 177/s i_avg: 218/s q_max: 8 i_ok: 65% o: 433/s ok: 69% ok: 122/s ok_avg: 63% ok: 8662410 ok_avg: 139/s d: 0
1665335597	i: 190/s i_avg: 218/s q_max: 9 i_ok: 60% o: 448/s ok: 64% ok: 123/s ok_avg: 63% ok: 8662534 ok_avg: 139/s d: 0
1665335598	i: 207/s i_avg: 218/s q_max: 7 i_ok: 64% o: 496/s ok: 65% ok: 136/s ok_avg: 63% ok: 8662671 ok_avg: 139/s d: 0
1665335599	i: 208/s i_avg: 218/s q_max: 8 i_ok: 59% o: 479/s ok: 61% ok: 128/s ok_avg: 63% ok: 8662800 ok_avg: 139/s d: 0
1665335600	i: 242/s i_avg: 218/s q_max: 14 i_ok: 58% o: 555/s ok: 59% ok: 143/s ok_avg: 63% ok: 8662944 ok_avg: 139/s d: 0
1665335601	i: 247/s i_avg: 218/s q_max: 17 i_ok: 42% o: 580/s ok: 43% ok: 107/s ok_avg: 63% ok: 8663052 ok_avg: 139/s d: 0
1665335602	i: 249/s i_avg: 218/s q_max: 18 i_ok: 39% o: 598/s ok: 39% ok: 98/s ok_avg: 63% ok: 8663151 ok_avg: 139/s d: 0
1665335603	i: 240/s i_avg: 218/s q_max: 20 i_ok: 44% o: 590/s ok: 45% ok: 109/s ok_avg: 63% ok: 8663261 ok_avg: 139/s d: 0
1665335604	i: 206/s i_avg: 218/s q_max: 19 i_ok: 57% o: 480/s ok: 58% ok: 120/s ok_avg: 63% ok: 8663382 ok_avg: 139/s d: 0
1665335605	i: 288/s i_avg: 218/s q_max: 22 i_ok: 46% o: 674/s ok: 48% ok: 138/s ok_avg: 63% ok: 8663521 ok_avg: 139/s d: 0
1665335606	i: 297/s i_avg: 218/s q_max: 19 i_ok: 48% o: 674/s ok: 49% ok: 146/s ok_avg: 63% ok: 8663668 ok_avg: 139/s d: 0
1665335607	i: 248/s i_avg: 218/s q_max: 18 i_ok: 49% o: 565/s ok: 51% ok: 127/s ok_avg: 63% ok: 8663796 ok_avg: 139/s d: 0
1665335608	i: 269/s i_avg: 218/s q_max: 18 i_ok: 48% o: 601/s ok: 49% ok: 133/s ok_avg: 63% ok: 8663930 ok_avg: 139/s d: 0
1665335609	i: 271/s i_avg: 218/s q_max: 19 i_ok: 43% o: 597/s ok: 44% ok: 119/s ok_avg: 63% ok: 8664050 ok_avg: 139/s d: 0
1665335610	i: 349/s i_avg: 218/s q_max: 20 i_ok: 33% o: 814/s ok: 34% ok: 120/s ok_avg: 63% ok: 8664171 ok_avg: 139/s d: 0
1665335611	i: 266/s i_avg: 218/s q_max: 11 i_ok: 43% o: 572/s ok: 44% ok: 117/s ok_avg: 63% ok: 8664289 ok_avg: 139/s d: 0
1665335612	i: 280/s i_avg: 218/s q_max: 9 i_ok: 44% o: 577/s ok: 47% ok: 132/s ok_avg: 63% ok: 8664422 ok_avg: 139/s d: 0
1665335613	i: 290/s i_avg: 218/s q_max: 11 i_ok: 54% o: 642/s ok: 58% ok: 168/s ok_avg: 63% ok: 8664591 ok_avg: 139/s d: 0
1665335614	i: 290/s i_avg: 218/s q_max: 9 i_ok: 47% o: 627/s ok: 48% ok: 141/s ok_avg: 63% ok: 8664733 ok_avg: 139/s d: 0
1665335615	i: 288/s i_avg: 218/s q_max: 9 i_ok: 55% o: 625/s ok: 57% ok: 165/s ok_avg: 63% ok: 8664899 ok_avg: 139/s d: 0

```
VOC: p-1664582403 000033893.2393 1619199616 83% -25.58|-081.82|18.06 179 DL LCW(0,T:hndof,C:handoff_cand,24f,1a0,010010011110110100000)
[25.df.45.e1.30.17.04.cb.98.a8.7e.d0.f1.25.3f.20.4a.cd.3e.fc.d0.2a.67.10.40.2b.28.88.e1.6
8.75.8a.9e.d8.ab.0a.d5.42.38]
IDA: p-1664582403 000033893.2406 1624449664 96% -24.92|-082.14|25.86 179 DL LCW(2,T:maint,C:maint[2][lqi:3,power:0,f_dtoa:2,f_dfoa:0],0|0)
000 cont=0 0 ctr=000 000 len=00 0:0000 [83.da.09.0f.ea.2f.c0.0b.41.20.cb.f4.05.fc.00.6f.c
0.07.fc.00.00.00.00] --- 0000
IBC: p-1664582403 000033895.1583 1623199616 100% -13.62|-081.83|39.73 133 DL bc:0 sat:082 cell:29 0 slot:0 sv_blkn:0 aq_cl:1111111111111111
aq_sb:22 aq_ch:2 00 101010110001111001000111110000 max_uplink_pwr:20 [] []
IBC: p-1664582403 000033899.0564 1625837696 96% -24.63|-082.24|29.44 138 DL bc:0 sat:103 cell:11 0 slot:0 sv_blkn:0 aq_cl:1111111111111111
aq_sb:30 aq_ch:2 00 0000 time:2022-10-01T00:00:36.83Z [000 Rid:232 ts:3 ul_sb:13 dl_sb:13 access:4 dtoa:-002 dfoa:00 00]
[]
IDA: p-1664582403 000033913.8993 1620004352 87% -27.00|-081.98|25.78 179 DL LCW(2,T:hndof,C:handoff_cand,24a,1b0,010010010100110110000)
001 cont=0 1 ctr=000 000 len=11 0:0000 [76.05.00.4d.aa.54.42.5a.50.88.f6]
8e7c/0000 CRC:OK 0000 SBD: v..M.TBZP.....
IBC: p-1664582403 000033920.2977 1622532992 92% -25.94|-082.09|18.76 140 DL bc:0 sat:082 cell:17 0 slot:1 sv_blkn:0 aq_cl:1111111111111111
aq_sb:20 aq_ch:2 00 101010110001111001000111110000 max_uplink_pwr:20 [] []
IDA: p-1664582403 000033922.2766 1620129280 98% -23.10|-082.08|27.91 179 DL LCW(2,T:maint,C:sync[status:1,dtoa:1023,dfoa:0],0|0)
000 cont=0 0 ctr=000 000 len=00 0:0000 [82.de.09.29.b0.a7.56.ab.ff.da.c3.b7.05.fc.00.6f.c
0.07.fc.00.00.00.00] --- 0000
IMS: p-1664582403 000033933.4753 1626420992 96% -25.15|-082.49|28.71 121 DL 8:A:09 len:03/T1/F00 1 0 000101011110010000000 0000000000000000
000000 00000000000000000000 00000000000000000000
VOC: p-1664582403 000033983.2384 1619199488 100% -17.99|-082.30|30.36 179 DL LCW(0,T:acchl,C:acchl[msg_type:0,bloc_num:0,sapi_code:0,segm_l
ist:00000001],0,00) [1e.57.8d.0c.bd.cf.7f.95.15.06.0d.02.75.07.e4.b1.0b.99.18.26.e7.16.a6.ac.dd.4a.de.1e.00.0
8.f6.6c.57.1c.11.46.02.04.3d]
IDA: p-1664582403 000034003.8981 1620212608 99% -23.61|-081.83|28.11 179 DL LCW(2,T:maint,C:switch[dtoa:1023,dfoa:0],000)
000 cont=0 0 ctr=000 000 len=00 0:0000 [82.de.09.29.b0.a7.56.ab.ff.da.c3.b7.05.fc.00.6f.c
0.07.fc.00.00.00.00] --- 0000
IDA: p-1664582403 000034012.2755 1620129280 95% -26.76|-082.09|27.73 179 DL LCW(2,T:maint,C:switch[dtoa:0,dfoa:0],000)
000 cont=0 0 ctr=000 000 len=00 0:0000 [82.de.09.29.b0.a7.56.ab.ff.da.c3.b7.05.fc.00.6f.c
0.07.fc.00.00.00.00] --- 0000
```



那麼，資安呢？

[Peter B. de Selding](#)
[@pbdes](#)

[@Eutelsat](#)

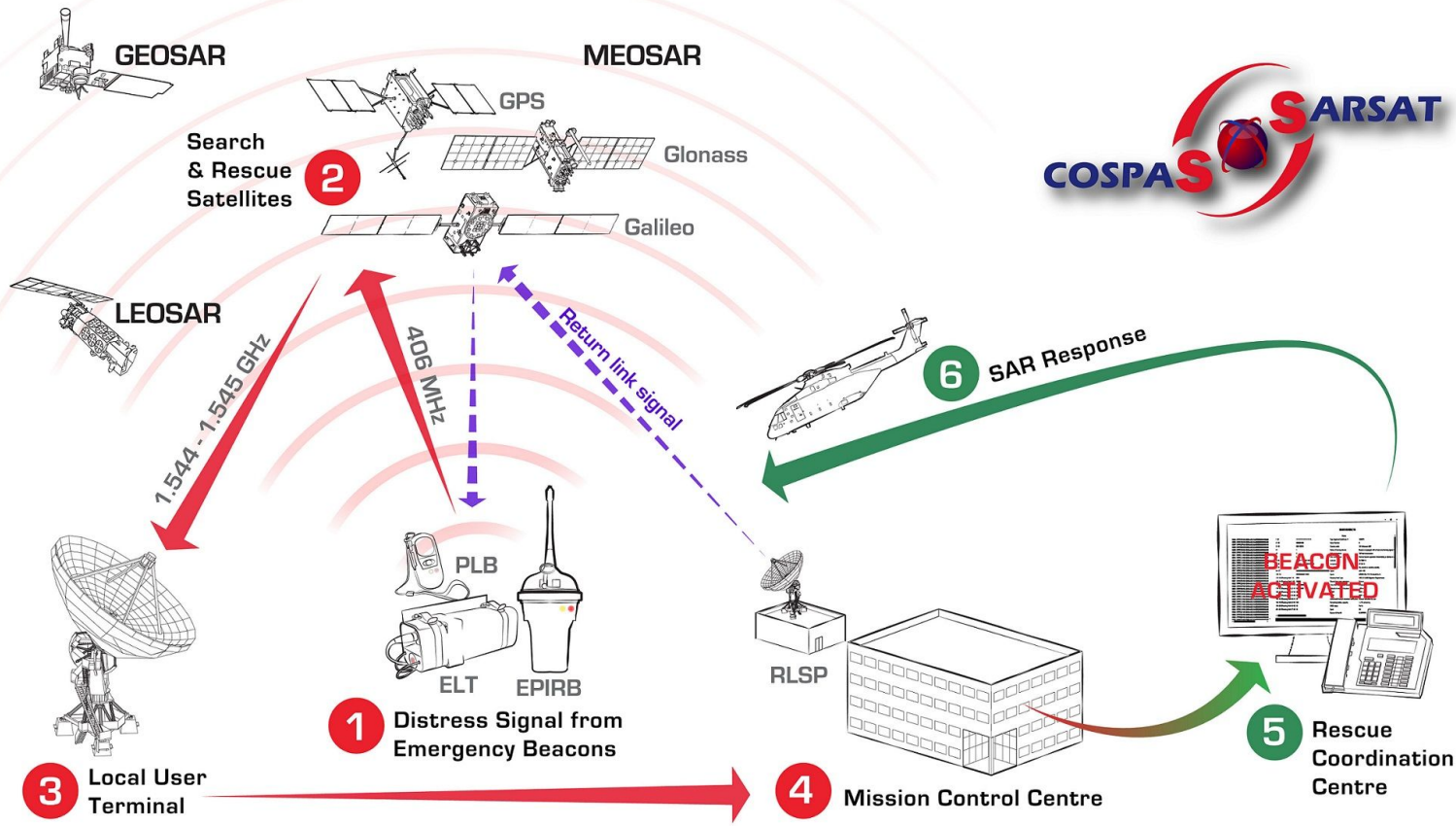
.
: **Jamming** of several of our Persian-language TV/radio channels broadcasting from outside Iran have been jammed since 26 Sept. from an uplink we've geolocated inside Iran. Diplomatic and technical remediation efforts under way. Here's Eutelsat's full statement:

"Since 26 September, Eutelsat has been experiencing jamming on two of its satellites. The interferences harmfully affect the transmission of several digital TV and radio channels broadcasting in Persian from outside of Iran, as well as other channels. As a result of measurements conducted with a specially designed interference detection system, Eutelsat concluded that the uplink transmissions of all these interfering carriers originated in Iran.

In order to remedy this situation in the shortest possible time, Eutelsat decided to take action simultaneously along two main lines: on the diplomatic front, and using all appropriate national and international procedures, Eutelsat has immediately notified the relevant authorities in the Islamic Republic of Iran, demanding that the harmful jamming operations be immediately and permanently stopped. Eutelsat has also reminded the relevant Iranian authorities that intentional jamming is explicitly prohibited by the International Telecommunication Union (ITU) Radio Regulations. Concurrently, on the technical front, Eutelsat's technical experts have been working around the clock with affected customers to mitigate the impact of the interference on service as much as possible."

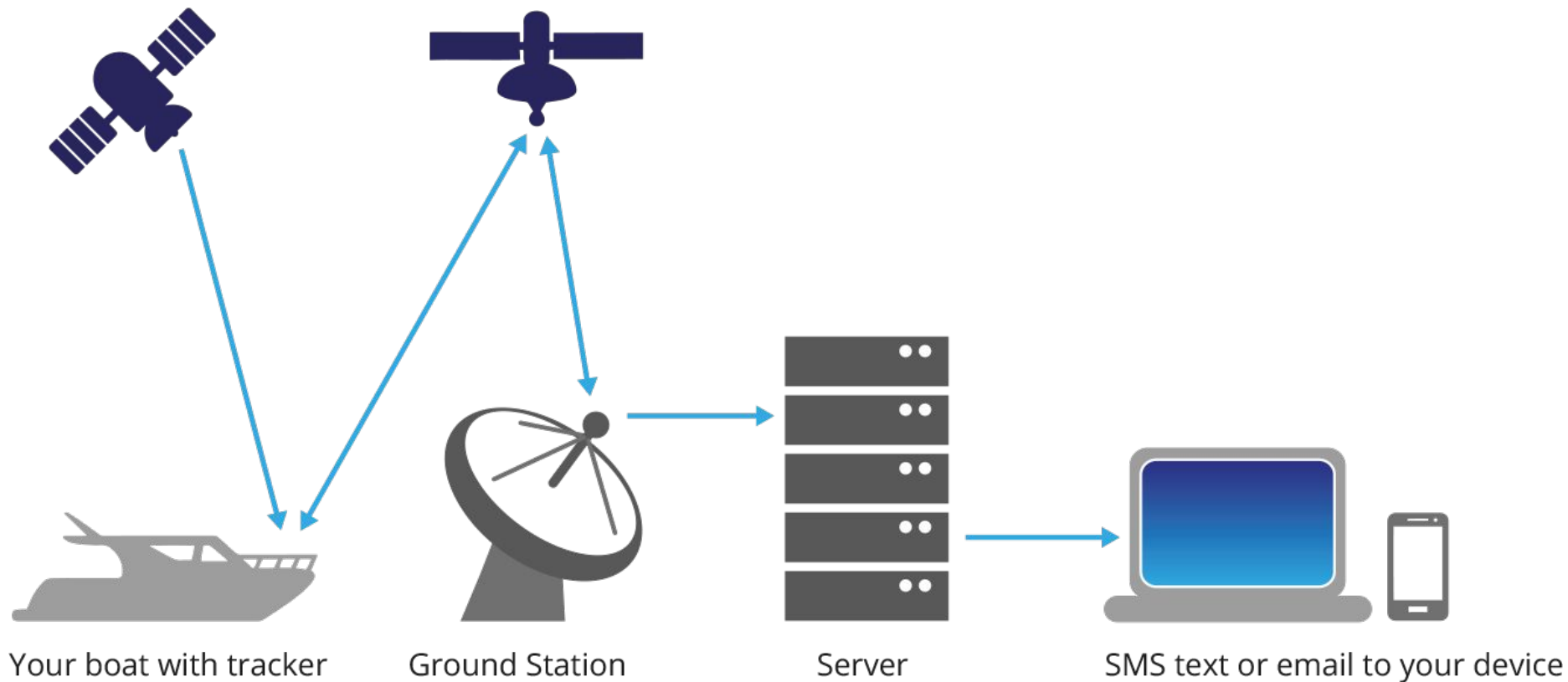


The Birdman and Cospas-Sarsat Satellites



GPS Satellite

Communications Satellite



(來源: <https://www.esoa.net/services/maritime.asp>)

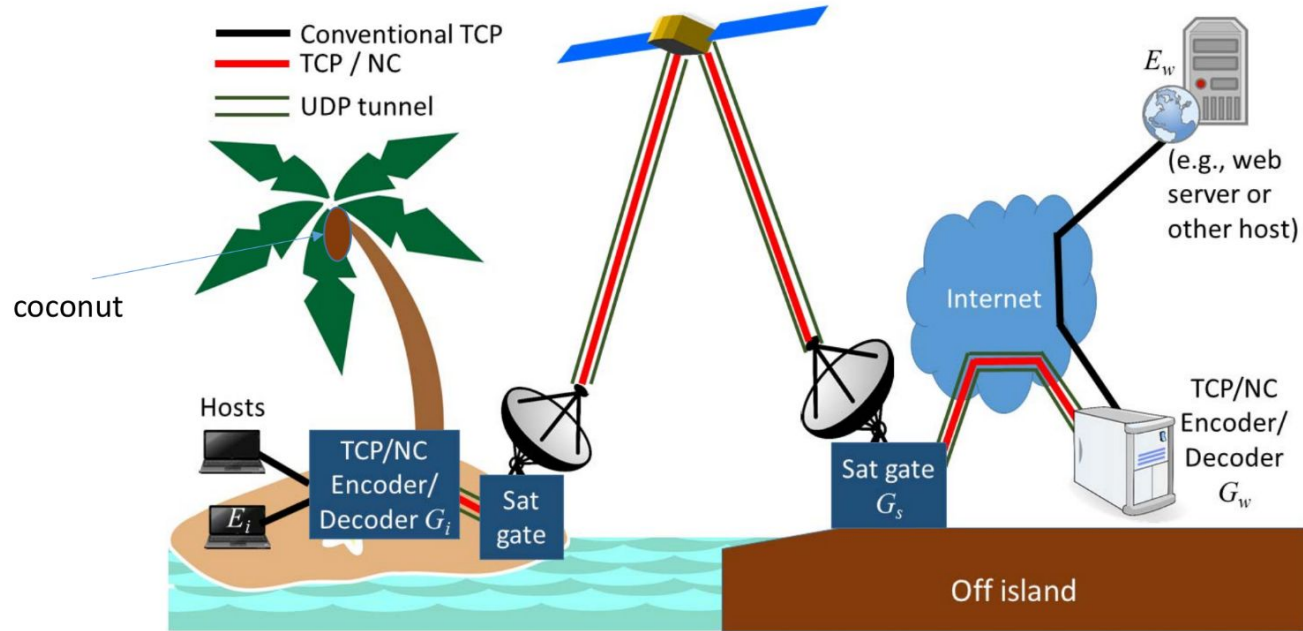
The background image shows a large satellite dish on a metal stand in the foreground, with a smaller dish visible to the right. In the background, there are palm trees and a small white building under a blue sky. The entire image has a blue tint.

Making the best of satellite links to Pacific Islands

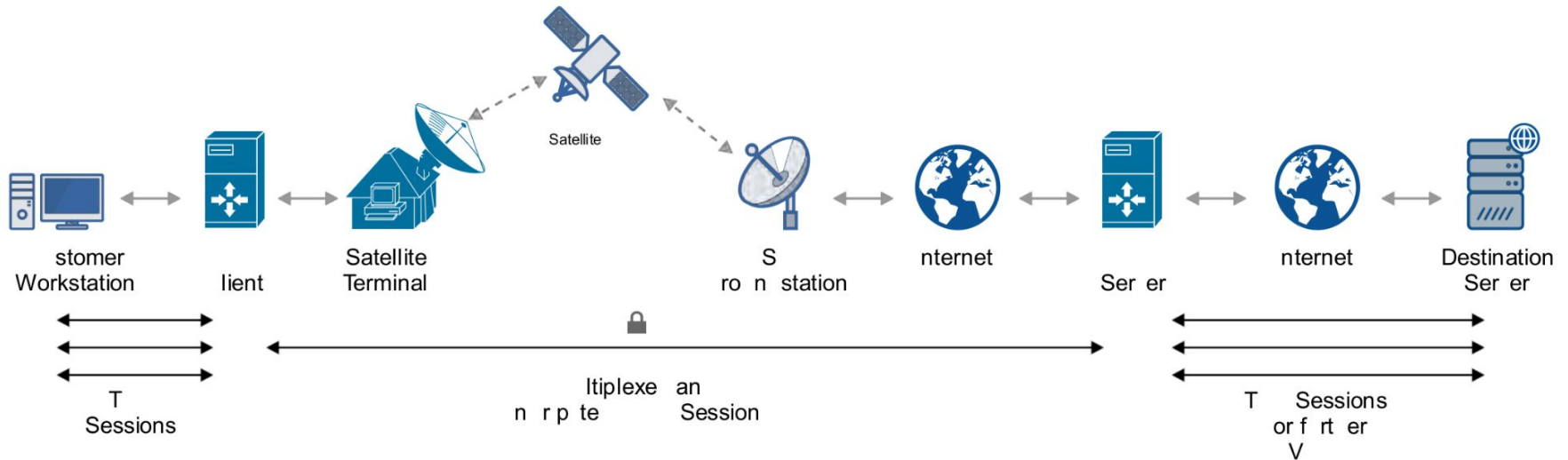
Ulrich Speidel, Lei Qian, 'Etuete Cocker, Péter Vingelmann, Janus Heide,
Muriel Médard

ulrich@cs.auckland.ac.nz

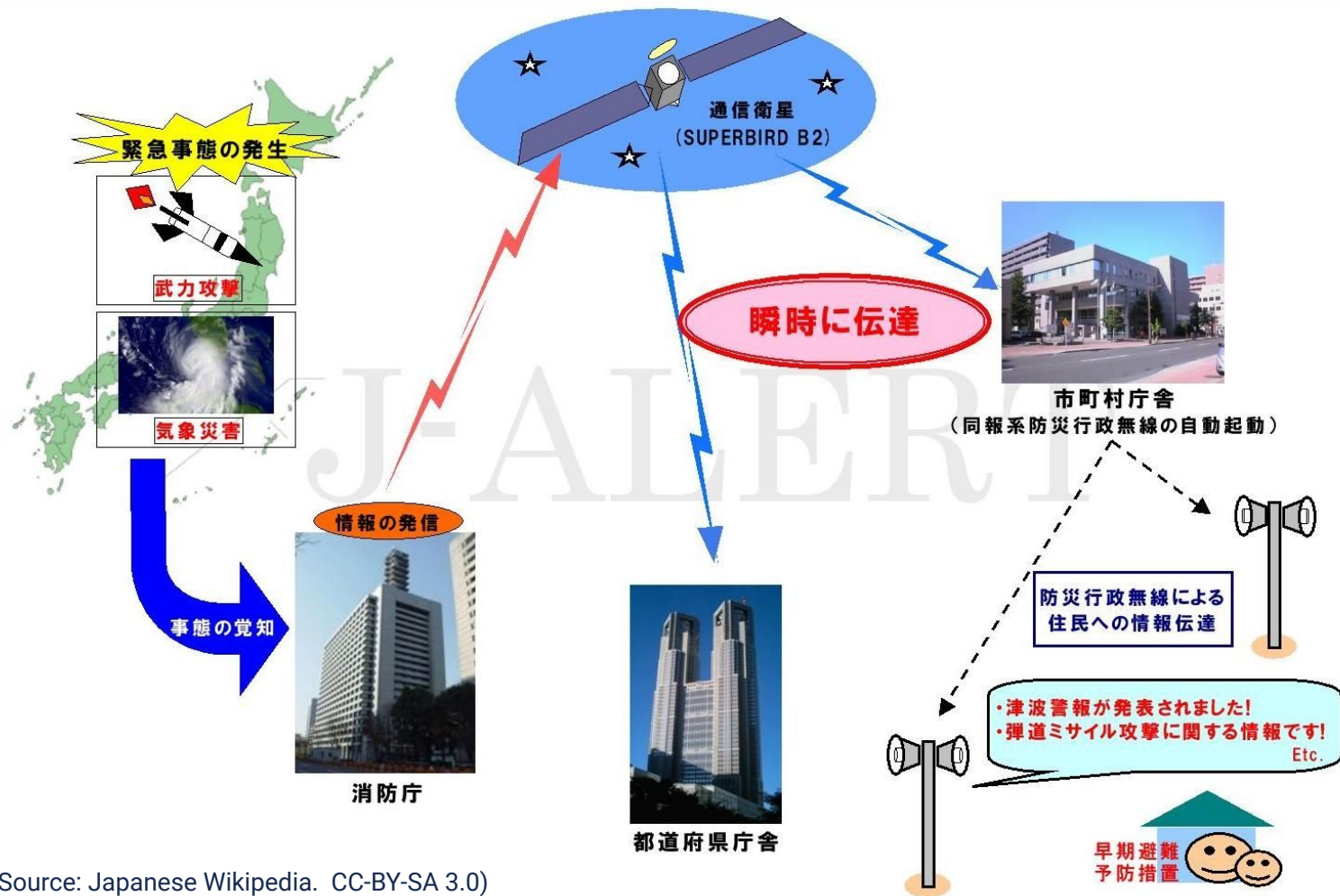
TCP/NC tunnel setup



Longer-Term – “QPEP”

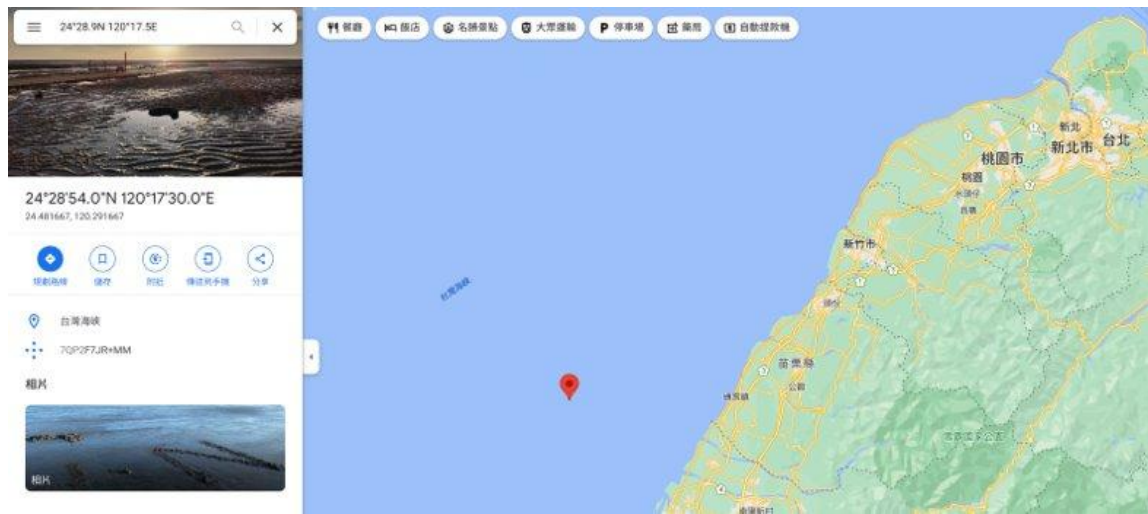


James Pavur, “Whispers among the stars”, BH US 2020

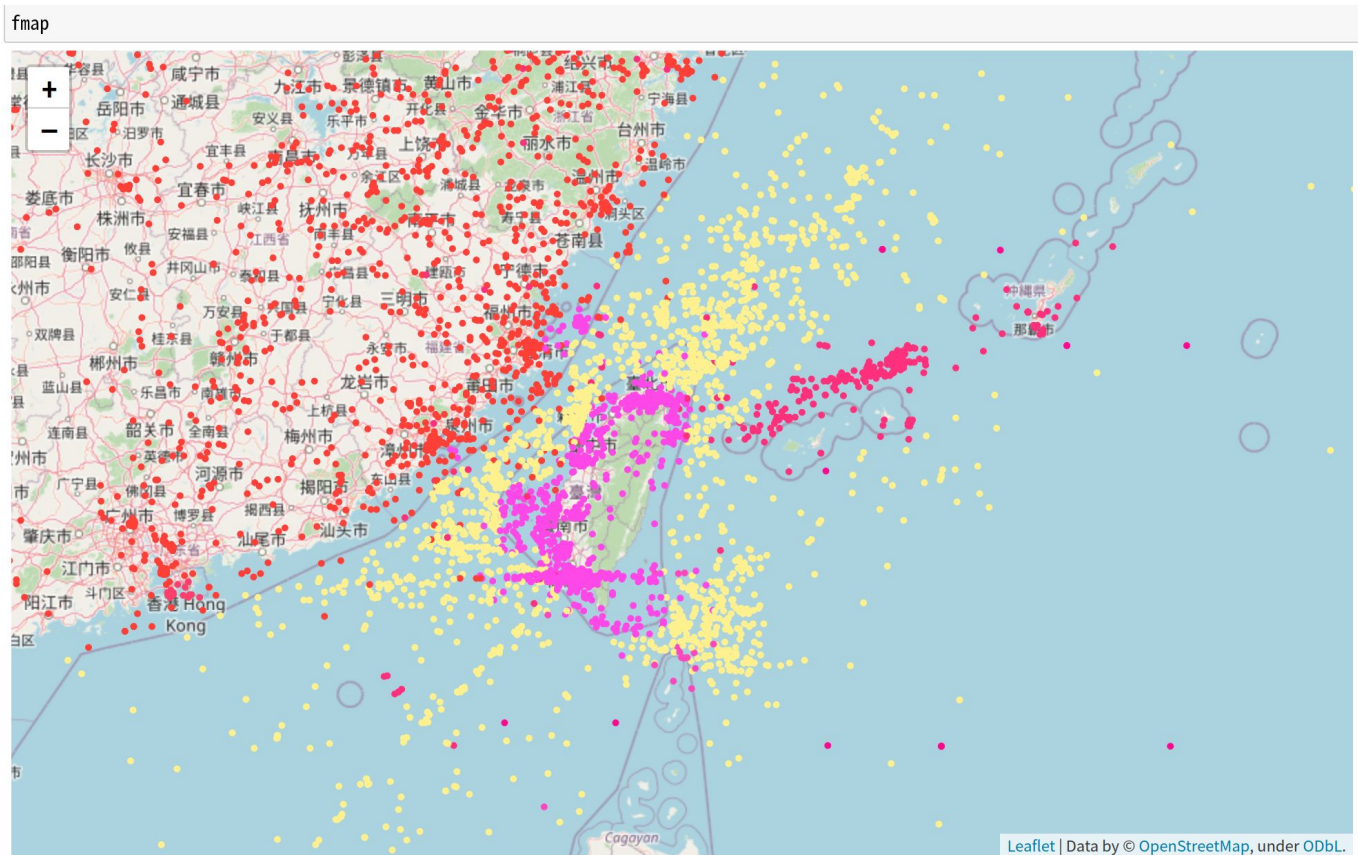


Iridium 明文訊息

- DELIVERED:24'28.9N/120'17.5E:629F5868002DFBB
- V:1:TT:2:N:1:PV:0:PRIO:3:CWA:0:TS:20220610214845:RID:
- 88662313707 (Taiwan, Kai Tai Culture & Creation Art Development Co., Ltd.)
- 85365568181 (Phone number in Macau)
- support@skyrouter.com ping (a fleet management company)
- iridiumgo@gap-us-1.globalalerting.com I am here Lat+24.933510 Lon+121.228957 Alt+3801ft GPS Sats seen 12 2015-05-18 19:10UTC <http://map.iridium.com/m?lat=25.009917&lon=121.406528> Sent via Iridium GO!



Iridium 波束定位



Iridium 語音

AMBE 編碼, 感謝大神們... 但是不能放進投影片 :)

後面還有很多學問...