ET Shadow, a brief explanation.

The ET Shadow experiment is a research project that is looking for volunteers capable of receiving and decoding the packet radio beacon from the ISS. It is open to all willing participants, you do not have to have an amateur radio operators license.
Now we shall assume that you can receive and decode the 1200 baud packet radio signals from the ISS That is all that you need, to be able to participate in an experiment called ET Shadow.
The ET Shadow experiment is designed to gather data on a phenomenon that occurs when Electric Thruster Ion Plasma engines are activated while pointing towards the Earth. Radio communications are disrupted by the discharge plume from the ET engine. Do you remember, the old black and white Batman, remember Batmans signal to commissioner Gordon, a huge searchlight on a cloud with a giant Bat in the middle of it. The bat is the Shadow in the searchlight beam, caused by a mask. The ET Shadow is a Shadow in the central portion of the ISS's radio footprint on the Earth when the Ion Plasma thruster is operating. The shape of the radio hole is not circular, but rather elongated in a North, South manner, in line with the Earth's magnetic field. The Shadow changes shape depending on what part of the world the thruster is operating over, hence this attempt to try and map the local distortions around the globe. After completion of the experiment, all participants will receive a certificate of participation.
Observe the image below.

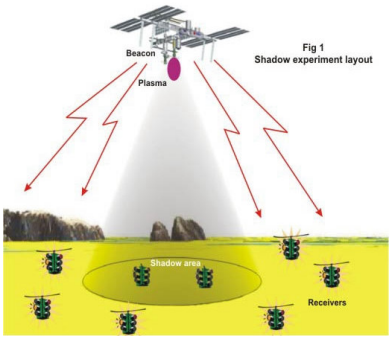
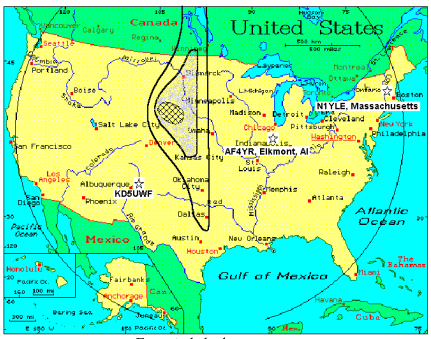


Fig 1
Shadow experiment layout

You can see that with enough ground stations, it will be possible to map the ET Shadow, as, some stations near the perimeter of the footprint may not experience a loss of communications, while stations directly beneath the ISS, may experience a total loss of signal for several minutes.

The map below displays an ET Shadow over the U.S. Data was obtained from a previous ET Thruster test flight onboard a cosmos satellite. For more info on ET Thrusters visit the TSNIIMASH URL below.



Expected shadow areas
Радиотени на Земле
f=2.4 ГГц f=430МГц f=144МГц

There are currently 8 participants in Australia. 23 in the U.S, 90 in Europe. More are needed.
To visit the main website, go to the TSNIIMASH website in Russia.
http://www.tsniimash.ru/Shadow/default_eng.htm or http://www.qsl.net/vk3ukf and follow the links.

ET Shadow Experiment
Phase 2

Electric Thrusters have been used successfully on several space missions already since the 1960's. Recently, a cosmos satellite carried an ET Ion Plasma Thruster for experiments, and they have been placed on two deep space vehicles, NASA's DEEP SPACE 1 and the ESA's SMART 1 Lunar probe. The main ET propulsion system on the last two vehicles is what got them to their destinations. An Asteroid and the Moon. ET engines cannot yet lift a vehicle from Earth into orbit. They usually have a thrust of a few grams only or uN or mN (microNewtons or milliNewtons) thrust. But their thrust is constant and over a period of days, builds up to an enormous velocity. Many kilometres per second.

Software for testing purposes has been released. It is called HostCom and is DOS software. It should be installed from a floppy disc. The software is to simulate an ISS beacon every 3 seconds or so. The idea is for a strong central station to be chosen to act as an ISS for ground testing. This station would broadcast a test beacon and other stations would record what they heard and send the records to a central analysis point.
A beacon on a beam rotating from one station to another or varying the transmitter power levels would produce signal variations observable in the records. At the moment this software only seems to work with TNC packet setups.
I am trying to organise software that will operate on windows. Most packet software is designed to prevent the duplication of packets for say at least 10 seconds or even 30 seconds. This is why we need a 'special for the job' piece of software.
If you are interested in participating in this phase 2 or the experiment in general, please visit the VK3UKF website, http://www.qsl.net/vk3ukf/ or the main TSNIIMASH website in Russia at http://www.tsniimash.ru/Shadow/default_eng.htm or you may glean more information from the European site at http://www.astrosurf.com/lombry/qsl-iss-shadow.htm

Remember, everyone participating in this project that forwards valid data to the principle investigators will be receiving a certificate of participation in a project that just may help put us all on the road to the stars.

Please keep in mind the following, while visiting the Russian website. Their English is a lot better than my Russian. A little meaning may be lost in the translation, but you should get the drift of it all.

Documents prepared by Kevin W. Forbes. VK3UKF. March 2004.
For R.A.A.F. Williams Amateur Radio Club VK3APP

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Packet Radio Operations
on board the
International Space Station Alpha (Zarya)

Kevin W. Forbes, VK3UKF. vk3ukf@hotmail.com March 2004.
Prepared for the R.A.A.F. Williams Amateur Radio Club. VK3APP.

The ISS has for a while now been operating a packet radio PMS or personal messaging system otherwise known as a BBS (Bulletin Board System). Digipeating (relaying of digital traffic) is also available. Voice communications are available to the crew only and cannot be repeated.
The equipment recommended for communications are 25 to 50 Watts, I have been using a 6 Watt hand held and a RF power doubler. 12 Watts. Antenna, 2m 5/8 mobile. Vertical. The radio has cables connecting the speaker out to the computers sound card MIC socket, and from the sound card's speaker out to the radio's MIC input. Opto coupled connections are recommended mine are not. Noth ing has blown up yet. ϑ I heard from an amateur in Europe that made a connection using speakers and microphones sitting in front of each other.
I am currently using a program called AGW packet engine. Once this has been started and is running in the background, a program called UISS by ON6MU is run, this is a nice window interface for most 1200 baud satellite packet communications.
To communicate with the ISS or via the ISS using 1200 baud AFSK packet radio, the frequencies currently used are below, Crew to ground control 143.625 MHz. A secondary that may provide information as to why you are not working. ϑ If there are docking operations or space walking EVA's then the amateur equipment generally is turned off for the duration.

Packet operations worldwide.
Regions 1, 2 and 3
RX 145.800 MHz Hear signals from the space station.
TX 145.990 MHz Transmit to the space station.

The ISS's packet callsign is RS0ISS Romeo Sierra Zero India Sierra Sierra
The variations are for digipeating, RS0ISS-3
And for the BBS or PMS, RS0ISS-11

Voice operations. Narrow band FM
Region 1, Europe, Africa.
RX 145.800 MHz
TX 145.200 MHz

Region 2, North and South America.
RX 145.800 MHz
TX 144.490 MHz

Region 3, Asia, Australia.
RX 145.800 MHz
TX 144.490 MHz

The callsign used by the crew on the ISS for voice operations is generally NA1SS
November Alpha One Sierra Sierra, but they will probably call out something like,
(phonetic) En Ay Won Ess Ess See Cue See Cue En Ay Won Ess Ess.

<u>These frequencies can and have changed.</u>
Previously used downlinks (RX from ISS) and uplinks (TX to ISS)
1.
TX & RX
Simplex 145.800 MHz
2.
TX 145.825 MHz
RX 145.800 MHz

The 145.825 MHz uplink was used as an experiment in conjunction with the PCSAT, NO-44 satellite, this was to enable a double bird hop. TX to NO-44 on 145.825 MHz digipeated to ISS and again digipeated via ISS.
NO-44 is currently unavailable due to flat batteries and a non sun sync orbit.
NO-44 also has store and forward capabilities when operational, but the uplink frequencies must be obtained from Mr Bob Bruninga from the U.S. Naval Academy.

<u>8 Things you can do using the ISS.</u>
>>

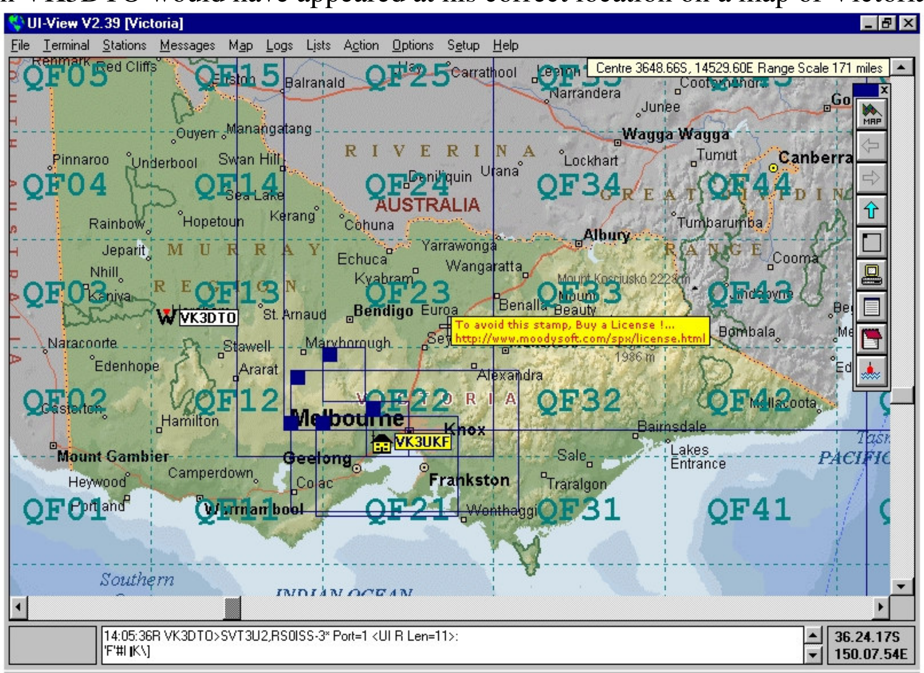
<u>1. SWL the signals from the ISS or eavesdrop on what traffic their may be during a particular overhead pass.</u>

Fm RS0ISS-11 To VK3TI <UA F >[19:52:04]
Fm VK3DTO To SVT3U2 Via RS0ISS-3* <UI pid=F0 Len=11 >[19:52:10]
'F'#l • K\]

Fm RS0ISS-11 To VK3TI <I P R0 S1 pid=F0 Len=22 >[19:52:10]
CMD(F/K/M/R/W/B/H/?)>

Fm VK3TI To CQ Via RS0ISS-3* <UI pid=F0 Len=1 >[19:52:38]

If you had been running an APRS program such as UI-View at the time of receiving these packets, the amateur station VK3DTO would have appeared at his correct location on a map of Victoria.



The U.S Air Force, Navy and Civil Aviation Authorities have experimented with APRS

2. Digipeat a signal via the ISS

Fm VK3UKF To APRS Via ARISS,SGATE,WIDE,INETZX <UI pid=F0 Len=8 >[15:24:30]
SIG TEST

Fm VK3UKF To APRS Via RS0ISS-3*,SGATE,WIDE,INETZX <UI pid=F0 Len=8 >[15:24:33]
SIG TEST

>>

3. Digipeat a signal from the ISS,

a. into the local APRS or packet network. You are acting as a Sat Gate for another OP.

Fm VK5AH-6 To S4U2U9 Via RS0ISS-3*,SGATE,WIDE <UI pid=F0 Len=36 >[18:12:11]
' BBSl"`R/]"4I} Probably stationary!

Fm VK5AH-6 To S4U2U9 Via RS0ISS-3,VK3UKF-2*,WIDE <UI pid=F0 Len=36 >[18:12:11]
' BBSl"`R/]"4I} Probably stationary!

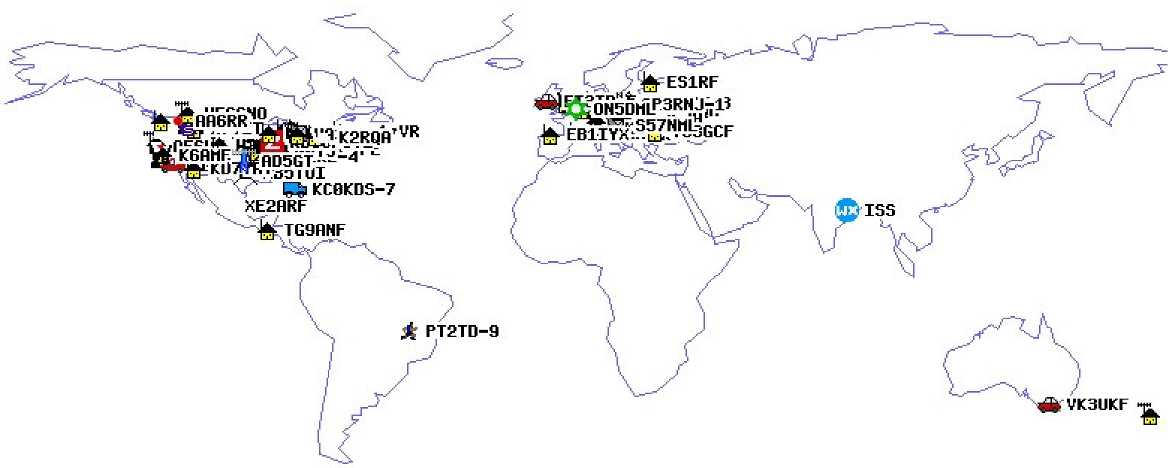
The above packets would also give a location on an APRS programs map.

OR

b. this is the best way to appear on the world Amateurs heard by ISS map, below example.
This is digipeating the ISS' s beacon.

Fm RS0ISS-3 To P0PPP0 Via SGATE,WIDE <UI pid=F0 Len=32 >[11:10:22]
' vX• l • ' /]APRS/BBS & Packet on.

Fm RS0ISS-3 To P0PPP0 Via VK3UKF-2*,WIDE <UI pid=F0 Len=32 >[11:10:22]
' vX• l • ' /]APRS/BBS & Packet on.



To do this, receive the ISS on 145.800 MHz and transmit into the APRS network on 144.900 MHz. You act as a Sat Gate, a digipeater function that is available in Ui-View, and a pre-set RX/TX split in the radio that is just for these frequencies. You should include in your path the following, SGATE, WIDE, INETZX, after the ISS call RS0ISS-3, This almost ensures a relay into the APRS network.
When digipeating, The ISS packet system will respond to either RS0ISS-3 or ARISS.

4. Send E-mail via the ISS (short msg, one line only, includes e-mail address)

Fm VK3UKF To APRS Via RS0ISS-3,SGATE,WIDE,INETZX <UI pid=F0 Len=49 >[19:51:32]
:EMAIL :vk3ukf@hotmail.com ISS TEST 18-02-2004

Fm VK3UKF To APRS Via RS0ISS-3*,SGATE,WIDE,INETZX <UI pid=F0 Len=49 >[19:51:35]
:EMAIL :vk3ukf@hotmail.com ISS TEST 18-02-2004

another,

Fm VK3UKF To APRS Via ARISS,SGATE,WIDE,INETZX <UI pid=F0 Len=49 >[09:02:45]
:EMAIL :vk3ukf@hotmail.com ISS TEST 16-03-2004

Fm VK3UKF To APRS Via RS0ISS-3*,SGATE,WIDE,INETZX <UI pid=F0 Len=49 >[09:02:48]
:EMAIL :vk3ukf@hotmail.com ISS TEST 16-03-2004

One that got through.

From : <ksproul@rci.rutgers.edu>
Sent : Wednesday, 4 February 2004 2:16:01 AM
To : vk3ukf@hotmail.com
Subject : APRS Message from VK3UKF

```
ISS 04-02-2004

--------------------------
Message received by MacAPRS IGate station WU2Z
Located in NO BRUNSWICK, NJ
APRS path = VK3UKF>APZ186,RS0ISS-3,VK5AH-4*,WIDE3-1,qAO,VK5UJ
```

>>

5. Store a message on the PMS computer.

This is an example from the previous PMS 2 yrs ago. The commands are different.
S for send has been replaced by W for write.

s cq@rs0iss-1
CQ de VK3UKF
Kevin VK3UKF calling CQ to all amateurs via the ISS PMS.
qsl either vk3ukf@hotmail.com or PMS
Ahh, Space Stations are wonderful!

Hoo Roo ' th Noo, See you in orbit. Kevin VK3UKF

/EX

CMD(B/H/J/K/KM/L/M/R/S/SB/SP/ST/SR/V/?)>
Subject:
Message:
Message saved as Msg # 1213
CMD(B/H/J/K/KM/L/M/R/S/SB/SP/ST/SR/V/?)>

6. Have a conversation station to station. (UNPROTO).

e.g. VK3KBV v RS0ISS-3 How ya goin Rob, testing a new antenna.
>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>

7. Connect to someone else' s BBS via the ISS.

Or in this case, be connected to by someone else.

Fm VK3UKF To APRS Via ARISS,SGATE,WIDE,INETZX <UI pid=F0 Len=9 >[17:05:28]
Hi VK7BBW

Fm VK3UKF To APRS Via RS0ISS-3*,SGATE,WIDE,INETZX <UI pid=F0 Len=9 >[17:05:31]
Hi VK7BBW

Fm VK7BBW To VK3UKF Via RS0ISS-3* <SABM P>[17:05:35]
Fm VK3UKF To VK7BBW Via RS0ISS-3 <UA F >[17:05:35]
Fm VK3UKF To VK7BBW Via RS0ISS-3 <I P R0 S0 pid=F0 Len=246 >[17:05:36]

Welcome! You are connected to my UISS BBS

//H, //R, //S, //DIR, //L, //I, //VER, //BELL, //ECHO, //REMOTE, //PASWORD, //Q
//H = Help about all commands //S = send a message //Q = quit and disconnect

If you were at a packet radio console, the string entered at VK7BBW for the above example would have been,
C VK3UKF V RS0ISS-3
>>>>>>>>>>>>>>>>>

8. Relay your position in APRS format.

to appear live on other stations maps that may be listening. You can also be relayed into the APRS network if there is a Sat Gate operating.

Fm VK3UKF To APU16N Via WIDE,INETZX <UI pid=F0 Len=22 >[16:27:43]
>010527zUI-View V2.39

Fm VK3UKF To APU16N Via RS0ISS-3*,INETZX <UI pid=F0 Len=22 >[16:27:47]
>010527zUI-View V2.39
or
Fm VK3UKF To APRS Via ARISS,SGATE,WIDE,INETZX <UI pid=F0 Len=54 >[17:05:07]
=3752.32S/14442.01E-http://www.qsl.net/vk3ukf {UISS33}

Fm VK3UKF To APRS Via RS0ISS-3*,SGATE,WIDE,INETZX <UI pid=F0 Len=54 >[17:05:12]
=3752.32S/14442.01E-http://www.qsl.net/vk3ukf {UISS33}

>>>>>>>

Do Not's

1. Do this…….

Fm RS0ISS-3 To P0PPP0 Via SGATE,WIDE <UI pid=F0 Len=32 >[01:09:23]
' vX• l • ' /]APRS/BBS & Packet on.

Fm RS0ISS-3 To P0PPP0 Via VK3UKF-2*,WIDE <UI pid=F0 Len=32 >[01:09:23]
' vX• l • ' /]APRS/BBS & Packet on.

Fm RS0ISS-3 To P0PPP0 Via VK3UKF-2,RS0ISS-3* <UI pid=F0 Len=32 >[01:09:26]
' vX• l • ' /]APRS/BBS & Packet on.

I left the digipeater on simplex and bounced the ISS's beacon back at itself, which it in turn re broadcast.

The current set of commands in use for operating the ISS's packet radio PMS computer

The explanations are in order of left to right as taken from the current PMS prompt.

CMD(F/K/M/R/W/B/H/?)>

F = File. Show the latest 20 messages.

K = Kill. Type K n to delete the number n message. Only to or from you. e.g. k 284

M = Mine. Type M to show the latest 20 messages to or from you.

R = Read. Type R n to read the message number n. e.g. r 285

W = Write. Type W then the callsign then the message header then the message then end the message with /EX

B = Bye. Type B to Disconnect.

H or ? = Help. Display the PMS help file.

Other commands are,

A = Abort. Type A to abort.

J = Stations connected list. Type J.

L = List. Type L to show all the messages.

>>
In order to connect to the ISS's BBS from a console, enter the following,

C RS0ISS-11

After receiving a connected message,

Welcome to RS0ISS' s message board
System Ver 1.50 91932 Bytes free
You have following mails waiting.
CMD(F/K/M/R/W/B/H/?)>

all the commands above will work. Always wait for the command prompt
CMD(F/K/M/R/W/B/H/?)>
to reappear BEFORE sending the next command, lest you get a big fat
[ERROR]
Fm RS0ISS-11 To VK3UKF <I P R1 S1 pid=F0 Len=30 >[09:03:12]
CMD(F/K/M/R/W/B/H/?)>
[ERROR]

To Digipeat, the callsign for ISS is RS0ISS-3 or ARISS.
To use the BBS on the ISS, the callsign is RS0ISS-11

The ISS will be there on that rainy day, have fun, and, see you in orbit. Kevin