



LU TALKS On October 1st, 2021

Amateur Radio, so called “HAM RADIO”

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Abstract

"Communication" is fundamental technology and then extending various applications, not only engineering base but also human communication base and more.

Amateur radio is a popular personal hobby and service in international peace nations, authorized by the government with your unique radio station name (identification) which is only one in all over the world for your activities. Fundamental and key is "communication by radio spectrum", even the radio communication has various technologies, but also so many applications and services, and then not focusing technologies but people networking and contributing in public.

Under control of your radio authority and regulation, once you get the license of amateur radio you can transmit the radio wave in range of frequency of many spectrum bands (from Lower frequency of AM radio to almost light frequency). Also you can find many friends in all over the world, who is farmer, citizen, students, company staffs, officer of government, politician, from elementary school age to very senior age, and so on not only technology people but any kind of people, who enjoys the amateur radio.

Base technology is communication by radio wave, using transceiver or receiver with transmitter. Even a farmer can get the license and he/she can proudly discuss of his/her own theory of technologies with friends by getting practical experience not only learning from text book. Based on your own interest and other hobby and activities, you will be recognized in friends and can discuss and debate about your practical experience.



My Post card for the confirmation of the communication with its data



I love DX operation. The Operation shows on backside



What is Amateur Radio?

Amateur Radio, also known as “ham radio,” is a popular service and hobby that enables so many activities - from public service, to scientific experimentation, to sheer fun.

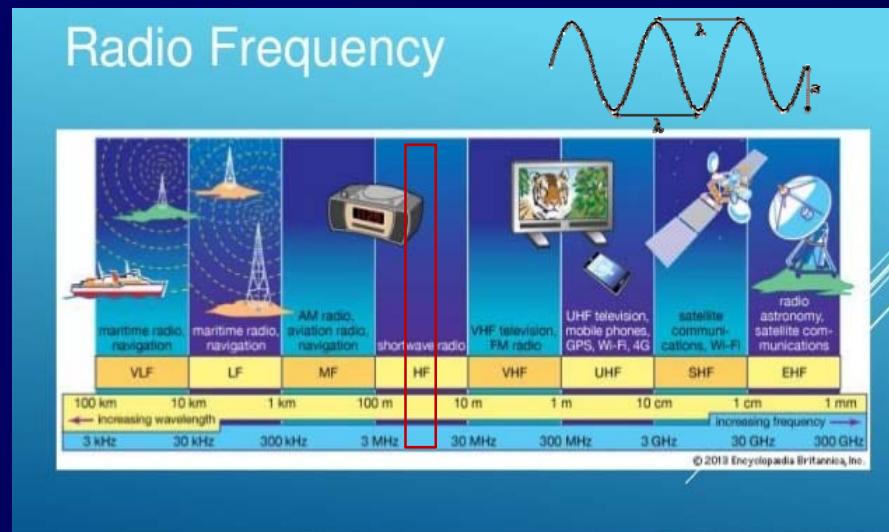
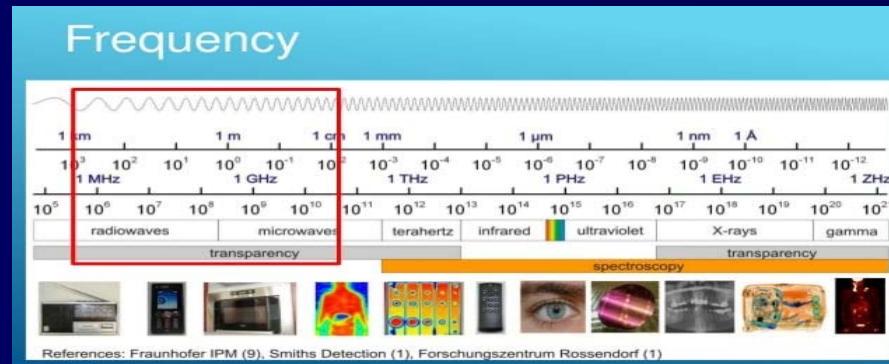
Amateur radio is the use of radio frequency spectrum for purposes of non-commercial exchange of messages, wireless experimentation, self-training, private recreation, radio-sport, contesting, and emergency communication. The term "amateur" is used to specify "a duly authorized person interested in radio-electric practice with a purely personal aim and without pecuniary interest (either direct monetary or other similar reward) and to differentiate it from commercial broadcasting, public safety (such as police and fire), or professional two-way radio services (such as maritime, aviation, taxis, etc.).

The amateur radio service (amateur service and amateur-satellite service) is established by the International Telecommunication Union (ITU) through the Radio Regulations.

Each National government regulates technical and operational characteristics of transmissions and issues individual station licenses with **a unique identifying call sign**, which must be used in all transmissions. Amateur operators must hold an amateur radio license which is obtained by passing a government test demonstrating adequate technical radio knowledge and legal knowledge of the host government's radio regulations.



Radio characteristics/propagation in spectrum



Relationship Speed, frequency and wavelength

$$\lambda = \frac{v}{f} \quad \text{or} \quad f = \frac{v}{\lambda}$$

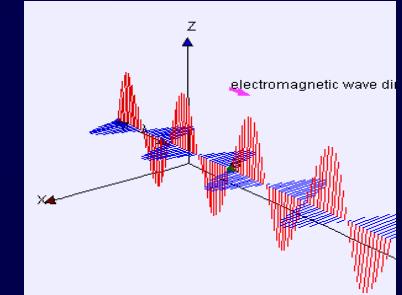
Where:

λ = wavelength in meters

v = velocity of radio wave
(speed of light)

f = frequency of radio wave
(in Hz, kHz or MHz)

Electro-magnetic wave

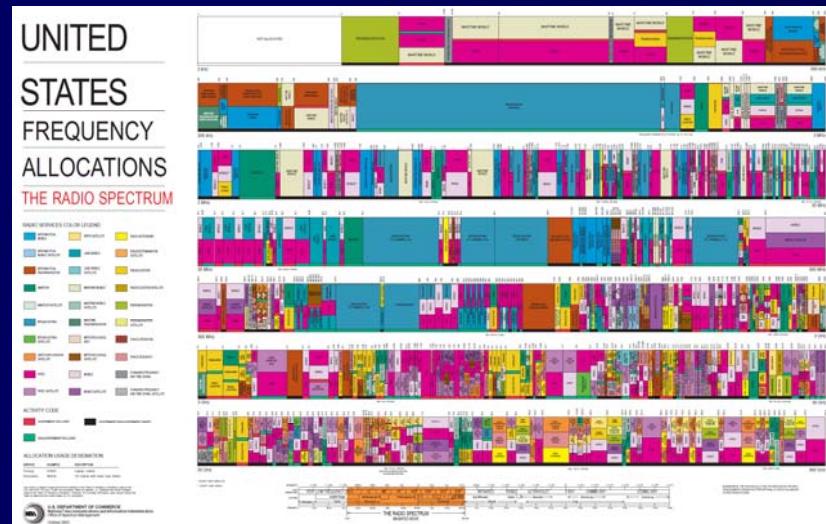


Maxwell equation

$$\begin{cases} \nabla \cdot \mathbf{B}(t, \mathbf{x}) &= 0 \\ \nabla \times \mathbf{E}(t, \mathbf{x}) + \frac{\partial \mathbf{B}(t, \mathbf{x})}{\partial t} &= 0 \\ \nabla \cdot \mathbf{D}(t, \mathbf{x}) &= \rho(t, \mathbf{x}) \\ \nabla \times \mathbf{H}(t, \mathbf{x}) - \frac{\partial \mathbf{D}(t, \mathbf{x})}{\partial t} &= \mathbf{j}(t, \mathbf{x}) \end{cases}$$



Spectrum Allocation for amateur radio



In USA, by recommendation of ITU

ITU (International Telecommunication Union)

Harmonization among all countries and territories
for communication and broadcast in all over the world

IARU (International Amateur Radio Union)

Harmonization among all amateur radio stations
For especially amateur radio operation

IARU Region 1

Europe and Africa region

IARU Region 2

North and South America

IARU Region 3

Asia and Oceania



Propagation



Light bulb

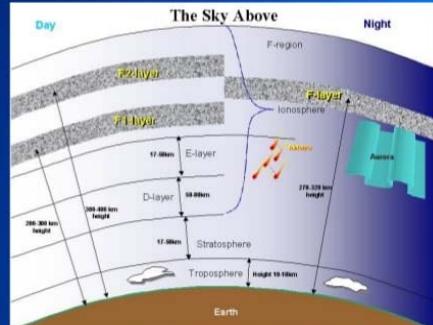


Radio

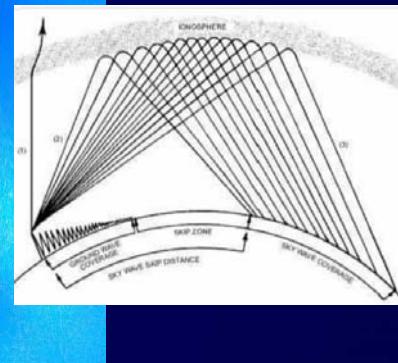
How many output power need to reach?

100m? 10km? Myanmar and Thailand?
Behind side of earth? To moon?

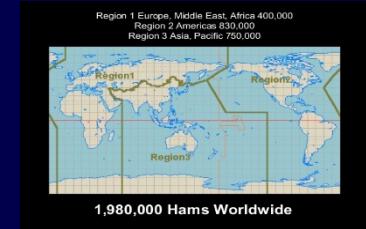
Layers of the Ionosphere



Example of Propagation



Ham friends;	
1	Japan 1296059
2	USA 679864
3	Thailand 141241
4	RO Korea 141000
5	Germany 79666
6	Chinese Taipei 68692
7	Spain 58700
8	UK 58426
9	Canada 44024
10	Russia 38000
11	Brazil 32053
12	Italy 30000
13	Indonesia 27815
14	France 18500
15	Ukraine 17265
16	Argentina 16889
17	Poland 16000
18	Australia 15328
19	Netherlands 14529
20	Sweden 10817
21	India 10679
22	Venezuela 10600
23	Denmark 10060
24	Hungary 9000
25	Czech Rep. 7086
26	Mexico 7059
27	Chile 7054
28	Slovenia 6500
29	Colombia 6500
30	Austria 6214





History

Old days

Spark Radio

Alexander's 200 Kw Rotary spark transmitter on 21.1 KHz
Rotor spun at 2170 RPM and water cooled. Installed at Naval Station in New Jersey in 1920 and generated a continuous wave

Reginald Fessenden

On Christmas Eve 1906, wireless operators on scores of ships and ham radio operators along the New England coast were stunned to hear Christmas carols cutting through the static and staccato rhythm of the Morse code.

January 1906 - Fessenden made the first successful two-way transatlantic transmission using Spark, exchanging Morse code messages between Brant Rock and an identical one built at Machrihanish in Scotland. (Note that Marconi had only achieved one-way transmissions at this time.)

December 24 1906 - Fessenden did the impossible. He invented a way of putting modulation on a carrier wave.

He used a 2KW 100KHz Alternator and he invented Amplitude Modulation (AM)

The way was open for Commercial and amateur radio voice transmission

Amateur Radio Firsts

In 1921, a challenge was issued by American hams to their counterparts in the United Kingdom to receive radio contacts from across the Atlantic. Soon, many American stations were beginning to be heard in the UK, shortly followed by a UK amateur being heard in the US in December 1922. November 27, 1923 marked the first transatlantic two-way contact between American Amateur Fred Schnell and French Amateur Leon Deloy BAB.

The transmitter used by Leon Deloy, BAB in France from 1923 to contact Fred (Fred Schnell) in the USA (Q-12 Mc) December, REF: Jean-Luc Freidel

1MO

Fred Schnell
1MO

At present



Amateur Radio

ITU

IARU

Amateur Radio Communication

Digital Mode Communication

- Best Digital Signal Practice

Satellite Communication



Who enjoying?

Not for only male technical engineer such like geek for radio!

Any people is authorized the amateur radio operation as the license in the operation place.

Age : no matter many young students, boys and girls, in of course elementary schools.

Male/Female: no matter, virous area: technical things, Communication with close, local and foreign countries, travel with communication, just chatting about personal matter.

Occupation: no matter: electric engineer, chemical engineer, management, officers, famer, explorer, sailor, sales man, teacher, professor, students, and King/Princess.

Communication should be open, popular language and any time as you want

Contribution upon emergency situation such as disaster, accident and so.





Call sign : Identification of radio station

AA + 0 + xxx

(prefix + number + Suffix)

Prefix : Authority

xxx: typically 3 letters

Call signs begin with a one- two- or three-character prefix chosen from a range assigned by the ITU to the amateur's country of operation or other internationally recognized jurisdiction. This is not necessarily always the amateur's country of citizenship. An individual operator is assigned a unique call sign beginning with this prefix and then completed with a separating numeral and suffix.

Call sign series	Allocated to
AAA-ALZ	United States of America
AMA-AOZ	Spain
APA-AWZ	Pakistan (Islamic Republic of)
ATA-AWZ	India (Republic of)
AXA-AKZ	Australia
AYA-AZ2	Argentine Republic
AZA-AJZ	Botswana (Republic of)
AZA-AJZ	Tonga (Kingdom of)
AZA-AJZ	Oman (Sultanate of)
ASA-ASZ	Bhutan (Kingdom of)
AGA-AGZ	United Arab Emirates
A7A-A7Z	Qatar (State of)
ABA-ABZ	Liberia (Republic of)
AHA-AH2	Bahrain (Kingdom of)
BAA-BZZ	China (People's Republic of)
CAA-CEZ	Chile
CFA-OKZ	Canada
CLA-CMZ	Cuba
CNA-CN2	Morocco (Kingdom of)
CDA-COZ	Cuba
CFA-CPZ	Bolivia (Republic of)
CQA-CUZ	Portugal
CVA-CXZ	Uruguay (Eastern Republic of)
CYB-CZZ	Canada
CZA-CZ2	Nauru (Republic of)
CJA-CJZ	Andorra (Principality of)
C4A-C4Z	Cyprus (Republic of)
C5A-C5Z	Gambia (Republic of the)
C6A-C6Z	Bahamas (Commonwealth of the)
C7A-C7Z	World Meteorological Organization
C8A-C9Z	Mozambique (Republic of)
DAA-DRZ	Germany (Federal Republic of)
DSA-DT2	Korea (Republic of)
DUA-DZZ	Philippines (Republic of the)
D2A-D3Z	Angola (Republic of)
D4A-D4Z	Cape Verde (Republic of)
DSA-D5Z	Liberia (Republic of)
D5A-D6Z	Comoros (Union of)
D7A-D9Z	Korea (Republic of)
EAA-EHZ	Spain
EIA-E3Z	Ireland

UAA-UIZ	Russian Federation
UJA-UMZ	Uzbekistan (Republic of)
UNA-UQZ	Kazakhstan (Republic of)
URA-UZZ	Ukraine
VAA-VGZ	Canada
VHA-VNZ	Australia
VOA-VOZ	Canada
VPA-VQZ	United Kingdom of Great Britain and Northern Ireland
VRA-VRZ	China (People's Republic of) – Hong Kong
VSA-VSZ	United Kingdom of Great Britain and Northern Ireland
VTA-VWZ	India (Republic of)
VXA-VYZ	Canada
VZA-VZZ	Australia
V2A-V2Z	Antigua and Barbuda
V3A-V3Z	Belize
V4A-V4Z	Saint Kitts and Nevis (Federation of)
V5A-V5Z	Namibia (Republic of)
V6A-V6Z	Micronesia (Federated States of)
V7A-V7Z	Marshall Islands (Republic of the)
V8A-V8Z	Brunei Darussalam
WAA-WZZ	United States of America
XAA-XIZ	Mexico
XJA-XOZ	Canada
XPA-XPZ	Denmark
XQA-XRZ	Chile
XSA-XS2	China (People's Republic of)
XTA-XTZ	Burkina Faso
XUA-XUZ	Cambodia (Kingdom of)
XVA-XVZ	Viet Nam (Socialist Republic of)
XWA-XWZ	Lao People's Democratic Republic
XKA-XXZ	China (People's Republic of)
XYA-XZZ	Myanmar (Union of)
YAA-YAZ	Afghanistan
YBA-YHZ	Indonesia (Republic of)
YIA-YIZ	Iraq (Republic of)



Various Interest in Amateur radio?

Communication with any amateur radio, close and all over the world

Discussing technical things, radio operation and social contribution

Communication by Voice, Morse code, Picture, Video, Digital mode, and relay

Satellite communication, making/design the satellite station

With the International Space Station

Communication by reflection of Moon, Earth-Moon-Earth communication

Reflection of Ionized layer in LF~HF~VHF : prediction of propagation

Reflection by outer space propagation

Direction finding (Radio fox hunting)

Ham radio over the Internet

Enjoying new and improvement of technology, Practically and experimentally



Learning and education of ICT, practically not at class room

Enjoying to develop system, application and service for amateur radio

Analyzing the propagation, transmitter and receiver

Fun to make vacuum tube equipment, repairing old/antique radio

Long distance communication by very low power output

Contest, competing the score of those communications

Activating radio amateur at none/few-amateur county, area, island and etc.

Collection of vintage equipment of radio, or then use as it was

Antenna projects,

Building High grade amateur radio station for better communication

Special events by radio

Support Education, Community, and more, contribution in disaster/emergency situation

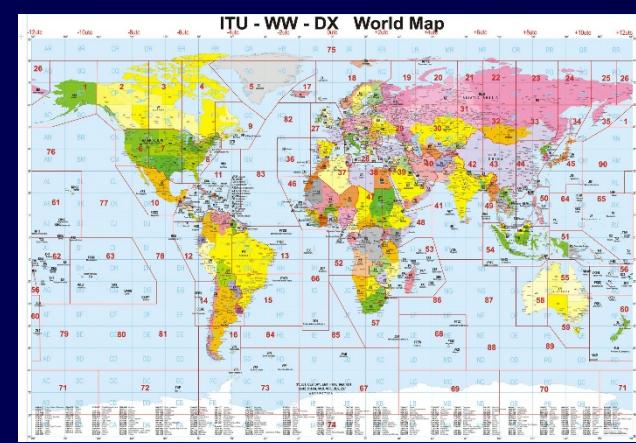
And more and more...



Activities, Practices and trial, even no class room study

Just required the license







The 1990s – The Rise of Computers & the Internet

Radio Propagation Information

Solar Data/Propagation
Click to add to your website
solar-Terrestrial Data

29 Mar 2014 2358 GMT

SFI	152	SN	132
R	7	K	3
X-Ray	B5.6		
304R	178.4	SEM	
PFO	O	EF	1
Aurora	Z/n=1.05		
Bz	-4.7	Sw	487.9

HF Conditions

Band	Day	Night
80m-40m	Fair	Fair
30m-20m	Fair	Good
17m-15m	Good	Good
12m-10m	Good	Fair

VHF Conditions

Rur Lat	58.6°
Aurora	Band Closed
6m EsEU	Band Closed
4m EsEU	Band Closed
2m EsEU	Band Closed
2m EsNR	Band Closed

EME Deg Fair
Solar Flare Prb 1.2%
MUF [15-SEARCH BREAK]
MS 0 6 12 18 VHF

Geomag Field 0.95E+10
Sig Noise Lvl 52-53
MUF US Boulder 33.93

Current Solar Image

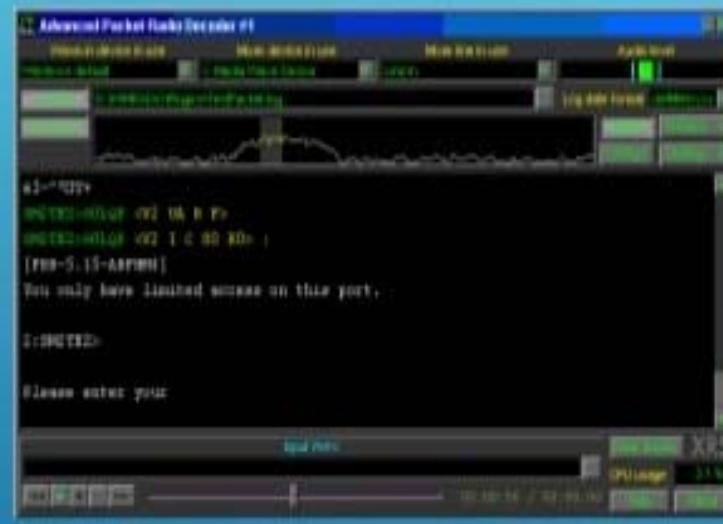
A small, circular solar image showing solar activity.

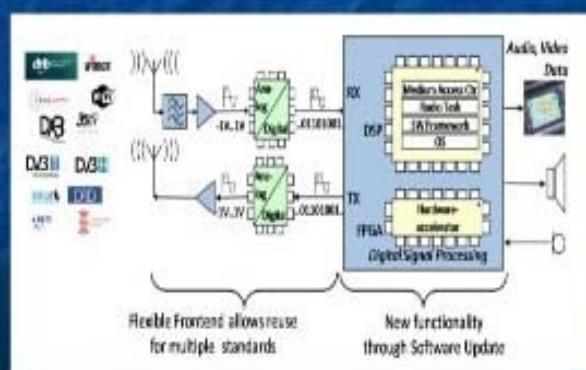
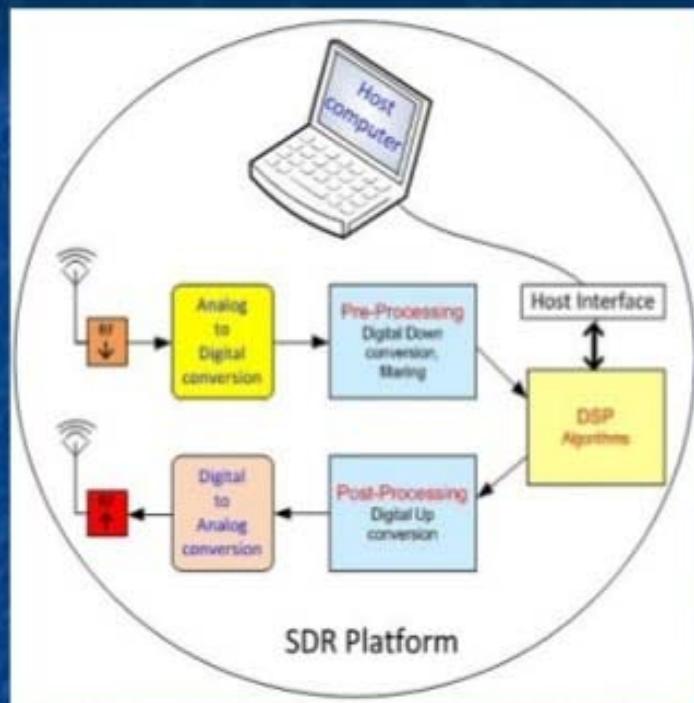
- Online and Real time
- See sunspot numbers
- Smoothed index
- Alpha Index
- K Index
- HF Conditions summary
- VHF conditions summary
- Geomagnetic fields
- Noise level
- MUF (Maximum Useable Frequencies)



Digital Mode Communication

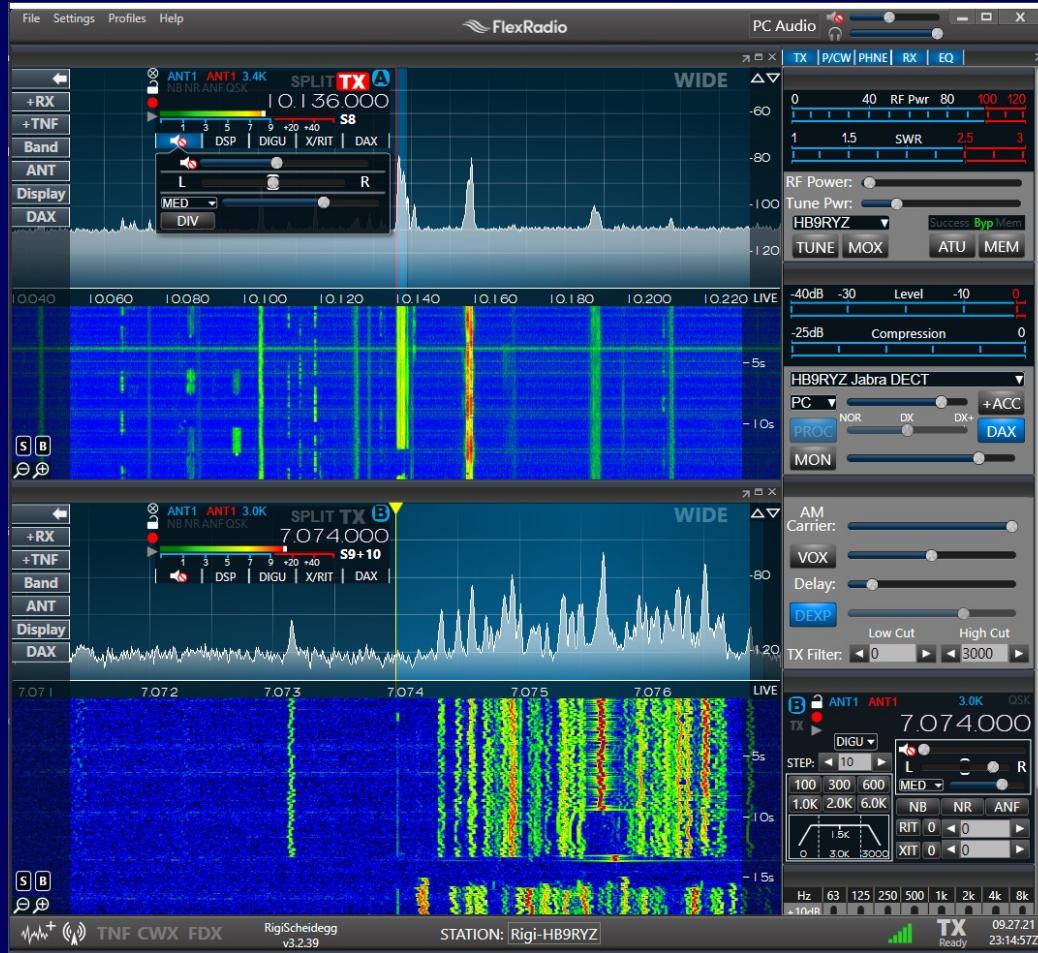
- Best Digital Signal Practice







Operation by remote computer with integrated screen





Satellite Communication



Amateur Radio Is:

- Fun
- Technical Experiments
- Social
- Public Service
- Applied Science
- Educational
- Global



1st Ham Radio Satellite 1961



High Earth Orbit (HEO)

- HEOs are satellites that orbit the earth at distances greater than 35,000km
- Pass times range from 12-18 hours
- Linear transponder (SSB/CW) only
- Inclined elliptical or geosynchronous orbit
- Operates over many bands
- AO-40 currently suffering from a low battery bus condition

AMSAT-UK

Low Earth Orbit (LEO)

- LEOs are satellites that are orbiting the earth from 400-2000 km.
- Pass times range from 12 to 22 minutes
- Linear Transponder (SSB/CW) or FM repeater
- Typically operate in the 2m/70cm bands
- Polar or high inclination orbit
- FM LEOs also referred to as the "easy sats"

AMSAT-UK

CubeSats

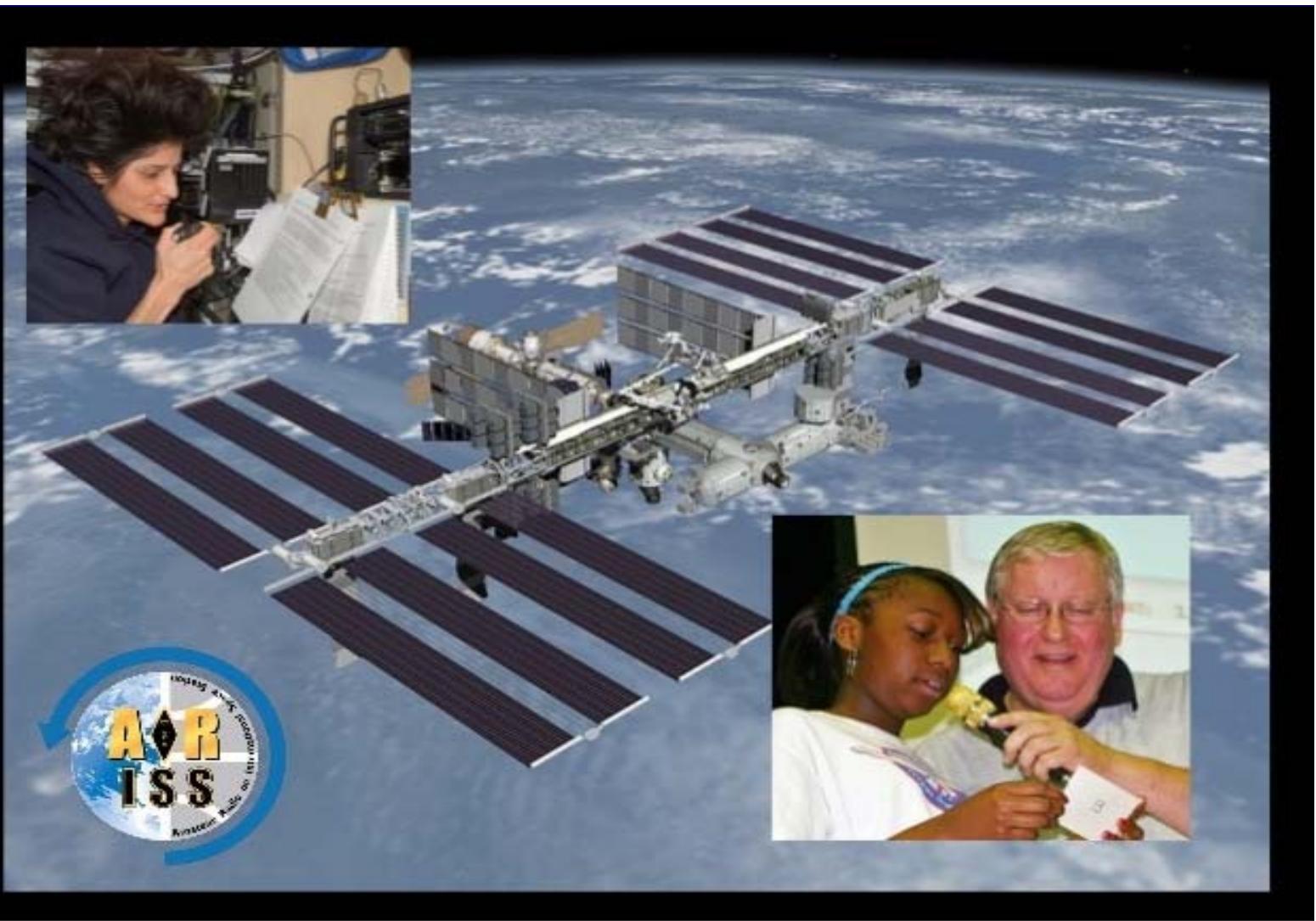
- Based on a 10cm cube but some can be a bit bigger
- Operate in Amateur Satellite allocation
- AX-25 protocol & others

AMSAT-UK

Student Satellites

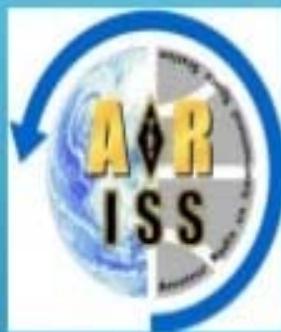
- PCSAT 1
- US Naval Academy Aerospace student project
- APRS protocol
- note the antennas!

AMSAT-UK



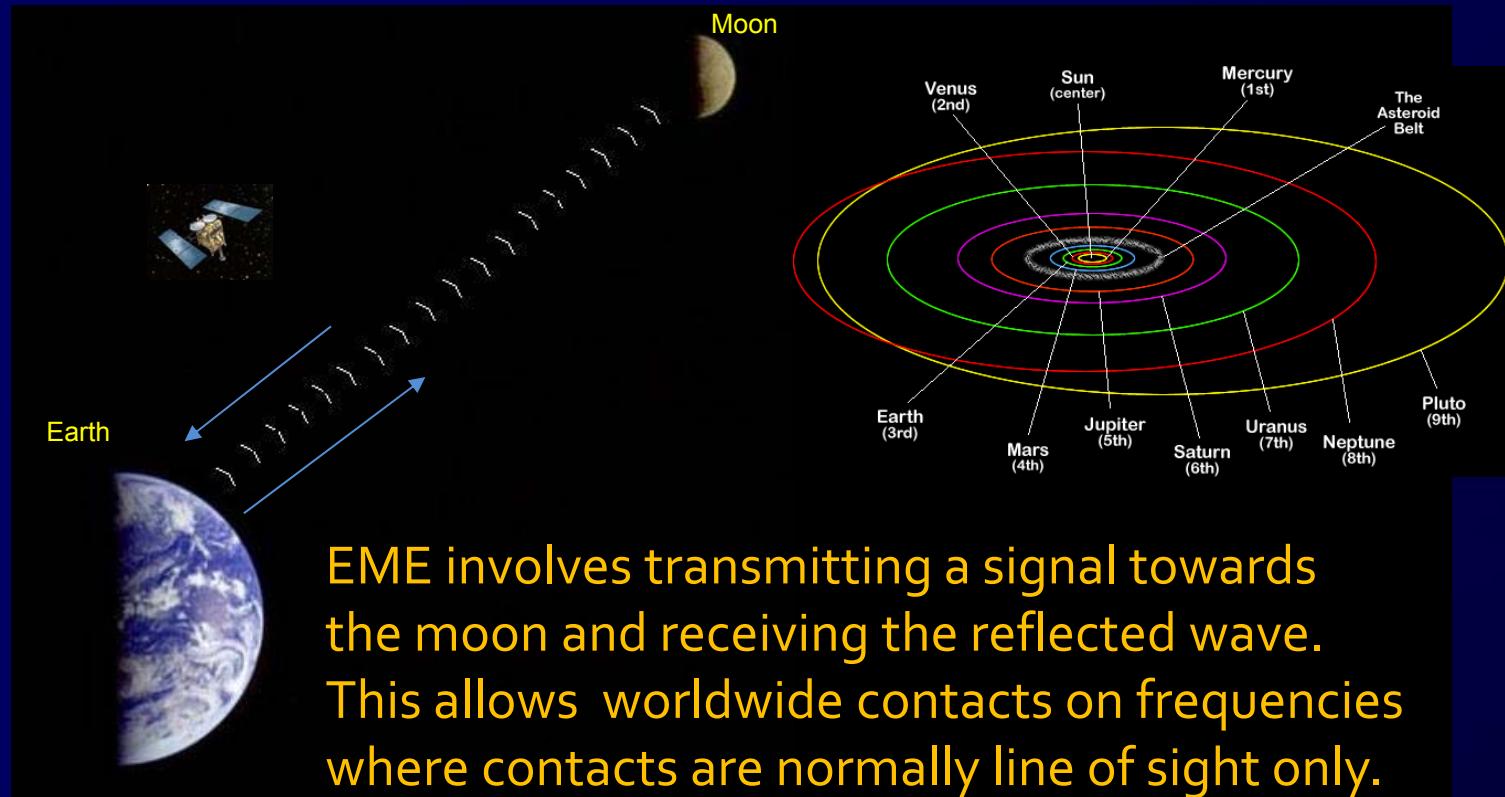


Amateur Radio on the International Space Station



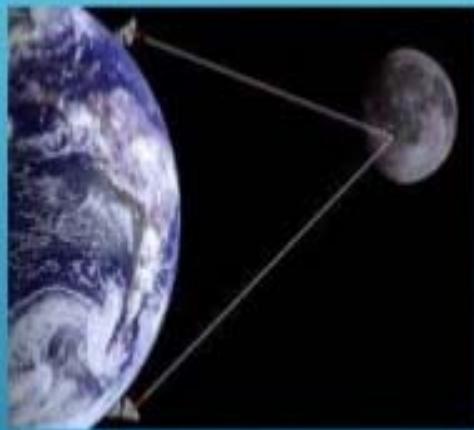


EME (Earth-Moon-Earth) communication





EME - Earth-Moon-Earth communication



- Very Loss of Signal
- High Power & High Gain ANT



ARDF Amateur radio direction finding



- Radio Sport

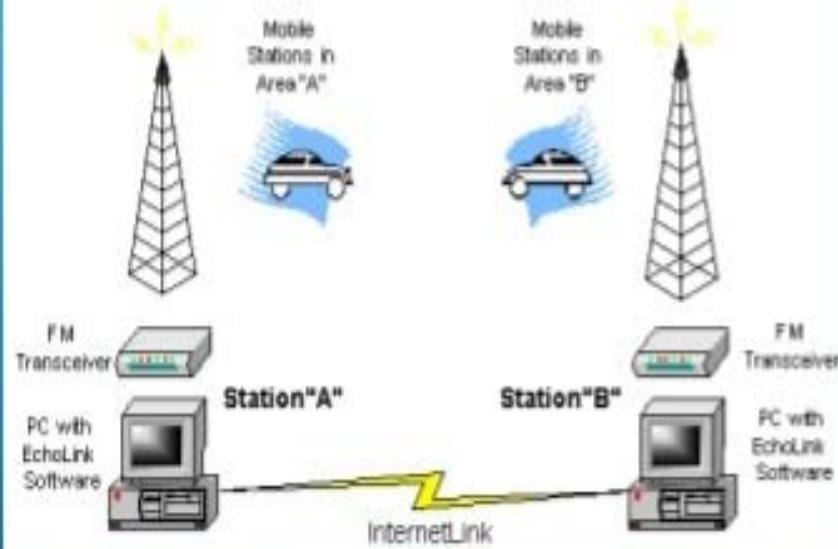




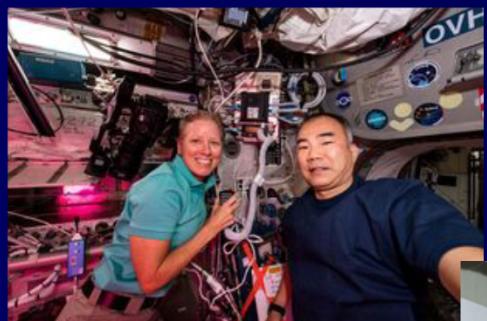


RoIP Radio over Internet Protocol

Linking Example



RoIP Software:
Echolink, D-STAR, WIRES, eQSO





What Do Hams Do?



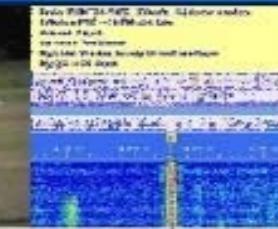
Amateur Satellites



Talk to Astronauts



Radio Control



Digital Modes



Phone

These are some of the cool things hams do:



Slow Scan TV



Radio Telegraphy



Homebrewing



Public Service



Vintage

QRP HF VHF Dxing Emcomm Technical
Contesting Satellites Digital SSTV
Space Communications



Fun For All Ages





Antenna Projects

- Tower installation
- Design & Construction
- Measure performance
- Mitigate interference
- Test during contests
- Constant improvement





Young adults learn radio



Amateurs like to build radios, antennas & other electronic equipment





Provide Emergency Communications for the Police and Other Authorities



- ◆ Amateur Radio is always there when disasters happen like earthquakes and fires when the cell phone networks are dead.



Amateur Radio Activity at Japan Earthquake and Tsunami



UHF Repeater and handheld radios







Special Events



- Middle School in St. Paul
- Talk to ISS Dr. Pettit
- Support education
- Lifetime achievement
- Community impact



Standard Code as common language

Code	Question	Answer or notice
QRA	What ship or coast station is that?	This is ____.
QRB	What is your distance?	My distance is ____.
QRC	What is your true bearing?	My true bearing is ____ degrees.
QRD	Where are you bound for?	I am bound for ____.
QRF	Where are you bound from?	I am bound from ____.
QRG	What line do you belong to?	I belong to the ____ Line.
QRH	What is your wavelength in meters?	My wavelength is ____ meters.
QRJ	How many words have you to send?	I have ____ words to send.
QRK	How do you receive me?	I am receiving (1–5). <i>(1) is unreadable and (5) is perfect.</i>
QLR	Are you busy?	I am busy.
QRM	Are you being interfered with?	I am being interfered with.
QRN	Are the <u>atmospherics</u> strong?	Atmospherics (noise) are very strong.



What is amateur radio (USA and UK)
<http://www.arrl.org/what-is-ham-radio>

[動画] 試験編(YouTube)
<https://www.youtube.com/watch?v=iPpGxR-dN3Q>

[動画] 無線運用編(YouTube)
<https://www.youtube.com/watch?v=I-a9m-7hAMw>

[動画] 無線局訪問編(YouTube) Nippon Institute of Technology
<https://www.youtube.com/watch?v=KRE4eVRJqys>

ARISS lets students worldwide experience the excitement of talking directly with crew members of the International Space Station, inspiring them to pursue interests in careers in science, technology, engineering and math, and engaging them with radio science technology through amateur radio.
<https://youtu.be/r73xSHwA9Vg>

Earth–Moon–Earth communication
Radio waves propagate in vacuum at the speed of light c , exactly 299,792,458 m/s. Propagation time to the Moon and back ranges from 2.4 to 2.7 seconds, with an average of 2.56 seconds (the average distance from Earth to the Moon is 384,400 km).

8N1EME-NHK-NEWS Long Version (NHK(Japan-Broadcasting Corp.))
https://www.youtube.com/watch?v=MJe_Fh4wqSs



Activities along with International Cooperation

Training Course and Contest in Myanmar

Network administrator training with APNIC in Myanmar

Application Contest among almost all Myanmar universities with ICT class

Projects for improving Digital Divide

2004 ~ 2021 by categorization (Japanese only on Sep 29th)

https://www.kddi-foundation.or.jp/cooperation/digital_divide/result/

https://www.kddi-foundation.or.jp/cooperation/digital_divide/current/

in Myanmar : Install Cloud computer networking among universities
in Thailand : Improving Emergency Medical Services

Publication at Asia Pacific Telecommunity

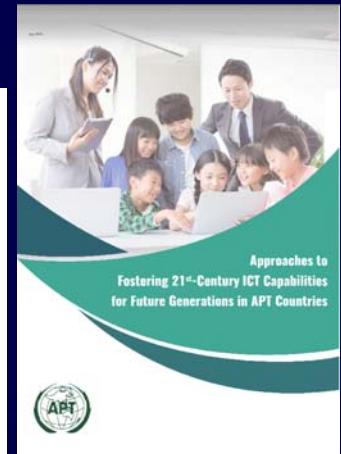
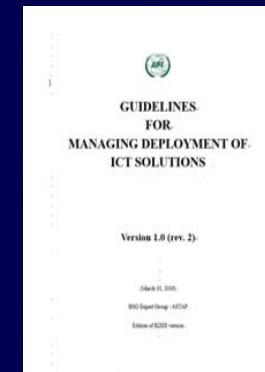
"Approached to Foster 21th Century ICT Capabilities for Future Generations in APT Counties"

https://www.apt.int/sites/default/files/Upload-files/ICT/Projects/New%20folder/Publication_2016_KDDI_v400_APT_FINAL.pdf

APT Standardization guideline for "Deploying ICT solutions"

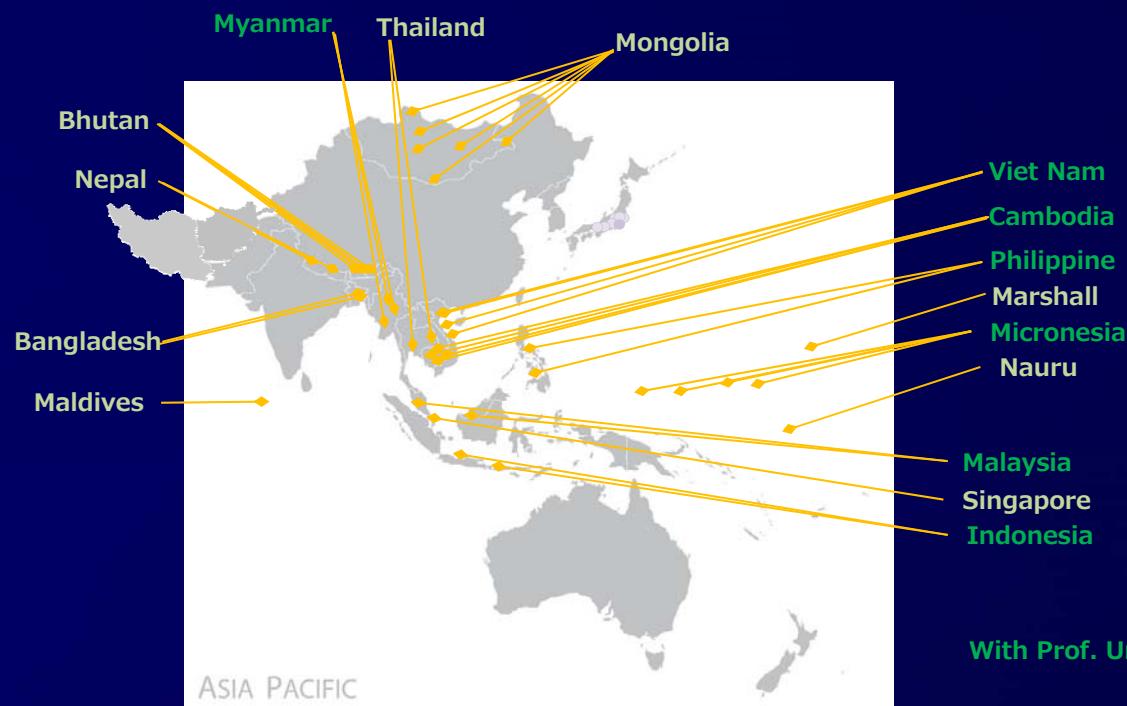
"GUIDELINE FOR MANAGEMENT OF DEPLOYING ICT SOLUTIONS"

https://www.apt.int/sites/default/files/2016/03/ASTAP-27-OUT-09-PSC__WG_-_Guideline_for_ICT_Solution.docx





Past project Activities with APT member countries and KDDI Foundation 2002-2020



With Prof. Urano Lab. In Waseda Universities



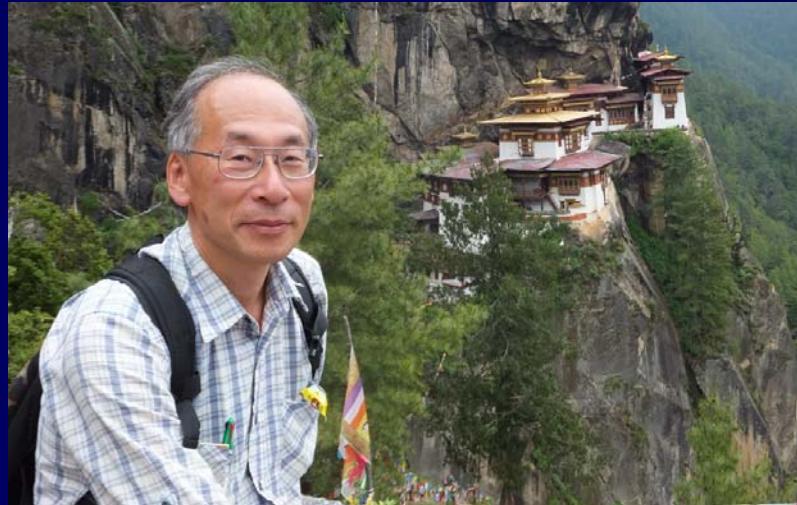
Reference:

ITU	https://www.itu.int/en/Pages/default.aspx
IARU	Global https://www.iaru.org/
	R3 https://www.iaru-r3.org/
ARRL	http://www.arrl.org/
RSGB	https://rsgb.org/
JARL	https://www.jarl.org/
RAST	https://www.rastmember.org/index.php

And several amateur radio associations, clubs and HP



Thank you very much



*Communication with international friends
through practical skill up*