

Aeronautical Communication and Navigation

Aeronautical charts, Radio frequencies, ATIS, NOTAM

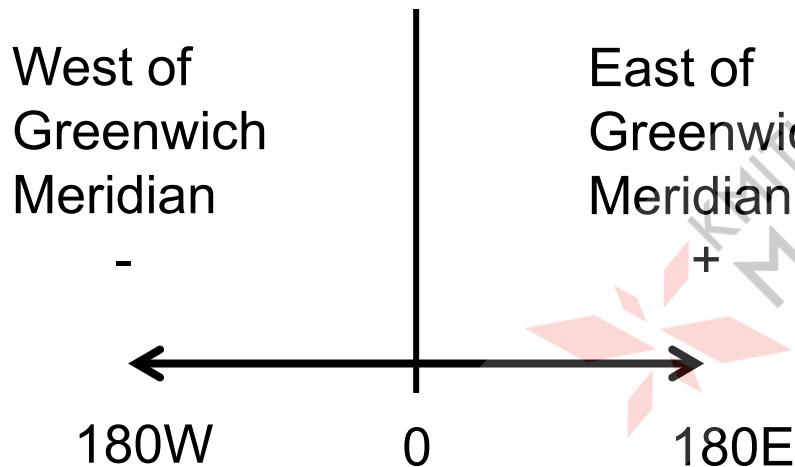
Professor Dr. Pornchai Supnithi

*Telecommunications Engineering Department, School of Engineering
Center of Excellence in GNSS and Space Weather*

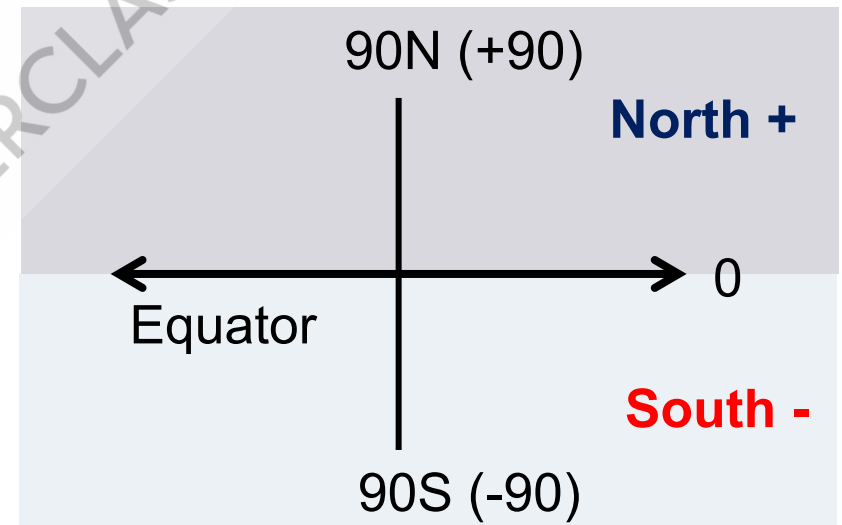
▶ <http://iono-gnss.kmitl.ac.th>

Sign convention for latitude/longitude

Longitudes or Meridians



Latitude



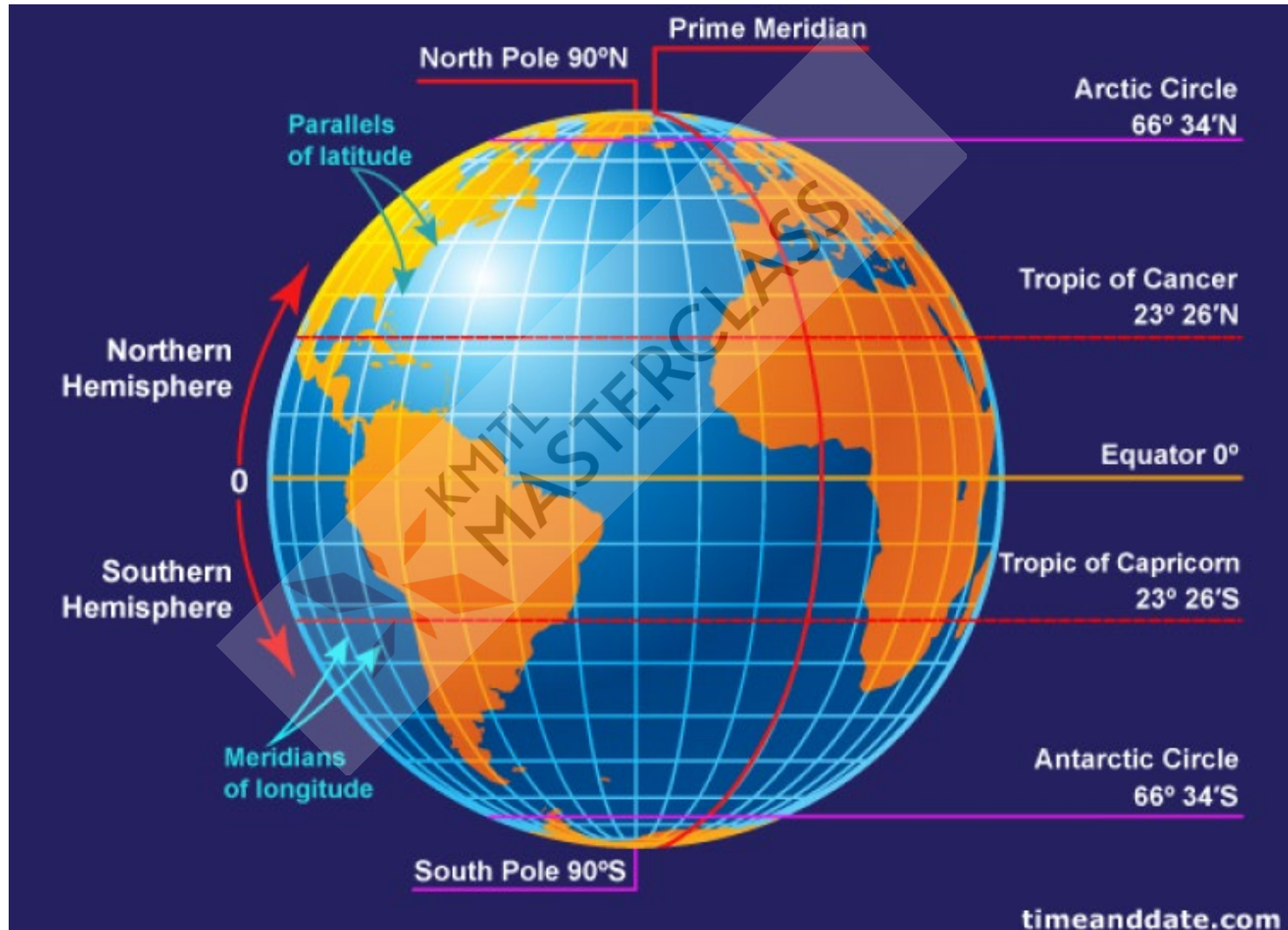
1 degree = 60 minutes
1 minute = 60 seconds

What is the GPS coordinate of Bangkok?

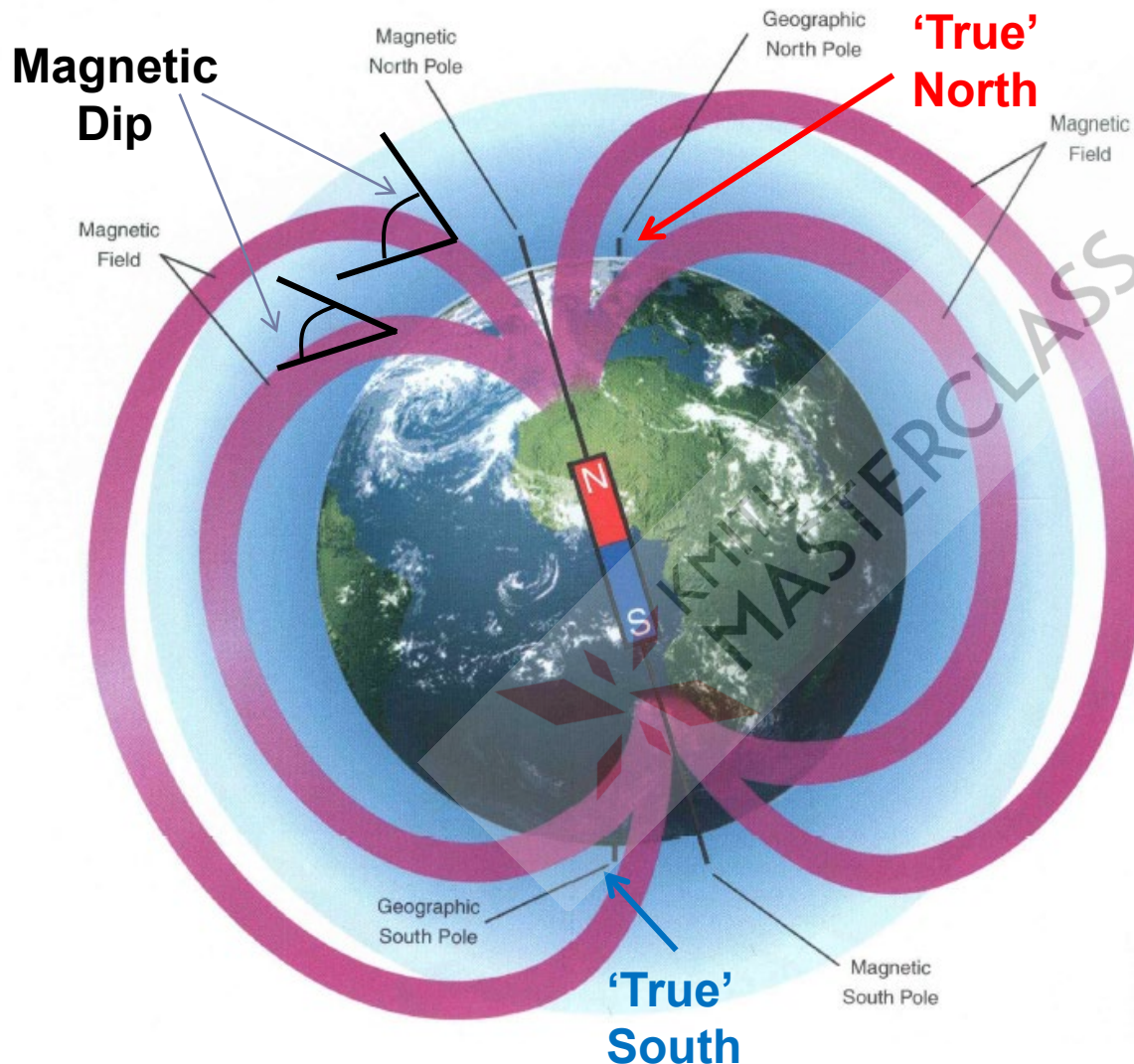
Lat = 13.727478°, Long = 100.775952°

Lat = 13.736717°, Long = 100.523186°

Latitudes and Longitudes



Magnetic dip angles



Magnetic Dip

deviation of geographic direction from magnetic direction

Near pole: Largest
Near equator: Smallest

**North direction
Pointed by compass**

Moving north pole?
Magnetosphere

Aeronautical charts

Aeronautical Chart = Map to assist navigation of aircrafts

Types of Aeronautical charts

1. Charts for Visual Flight Rule (VFR)
 - for VFR flights
2. Charts for Instrument Flight Rule (IFR)
 - for IFR flights with Instruments

Charts for Visual Flight Rule (VFR)

Types:

- ▶ **World aeronautical charts (WAC)** Scale 1:1,000,000
- ▶ **Sectional charts** Scale 1:500,000
- ▶ **Terminal area chart (busy airport)**

Information

- ▶ Contour lines (elevations)
- ▶ Terrains
- ▶ Topography (cities, towns, highways, railroads, and other distinctive checkpoints)
- ▶ Navigation and communication facilities
- ▶ Airspace
- ▶ ATC frequencies
- ▶ Obstructions

Aeronautical Information Publication:

<https://www.caat.or.th/th/archives/24518>

<http://www.skyvector.com>

VFR Sectional Chart

Non-towered Congested area
airport
Railway
Towered Airport (fuel, maintenance)
Class D Airspace up to 2500 ft
River



Class C Airspace

Private airport

121 MHz

CTC FORT MYERS APP WITHIN 20 NM ON 125.15 306.2

CTC FORT MYERS APP WITHIN 20 NM ON 126.8, 343.75

Bridge

Tower (329 ft above MSL, 316 ft above ground)
Highways
Tall Tower

Legends (Symbols)

- ▶ Airport symbols
- ▶ Airport data
- ▶ Radio aids to navigation and comm. Boxes
- ▶ Airport traffic service and airspace info
- ▶ Obstructions (Towers, Building, etc.)
- ▶ Topographic info (mountains, rivers, lakes, etc.)



Airport symbols

Public use airports:



Hard-surfaced runways greater than 8069' or some multiple runways less than 8069'



Hard-surfaced runways 1500' to 8069'



Other than hard-surfaced runways



Seaplane bases

Military airports:



Other than hard-surfaced runways










Fuel Available:



Tick marks around the basic airport symbol indicate that fuel is available Monday through Friday 10:00 AM to 4:00 PM local time.

AIRPORT TRAFFIC SERVICE AND AIRSPACE INFORMATION

Only the controlled and reserved airspace effective below 18,000 ft. MSL are shown on this chart. All times are local.

-  Class B Airspace
-  Class C Airspace (Mode C - see FAR 91.215/AIM.)
-  Class D Airspace
-  Ceiling of Class D Airspace in hundreds of feet (A minus ceiling value indicates surface up to but not including that value.)
-  Class E (sfc) Airspace
-  Class E Airspace with floor 700 ft. above surface
-  Class E Airspace with floor 1200 ft. or greater above surface that abuts Class G Airspace
-  **2400 MSL** Differentiates floors of Class E Airspace greater than 700 ft. above surface.
-  **4500 MSL**

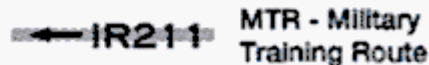
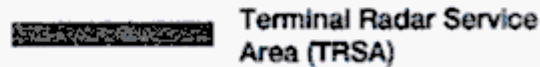
Class E Airspace exists at 1200' AGL unless otherwise designated as shown above.

Class E Airspace low altitude Federal Airways are indicated by center line.

Intersection - Arrows are directed towards facilities which establish intersection.



Class E Airspace low altitude RNAV Routes are indicated by center line.



Obstructions

VFR Waypoints

RNAV



Stand-Alone



Collocated with VFR Checkpoint



Obstruction

Above 200' & below 1000' AGL
(above 299' AGL in urban area)



Under Construction (UC) or reported and
position/elevation unverified



1000' and higher (AGL)



Wind Turbine



High-Intensity Obstruction Lights

Less than 1000' (AGL)



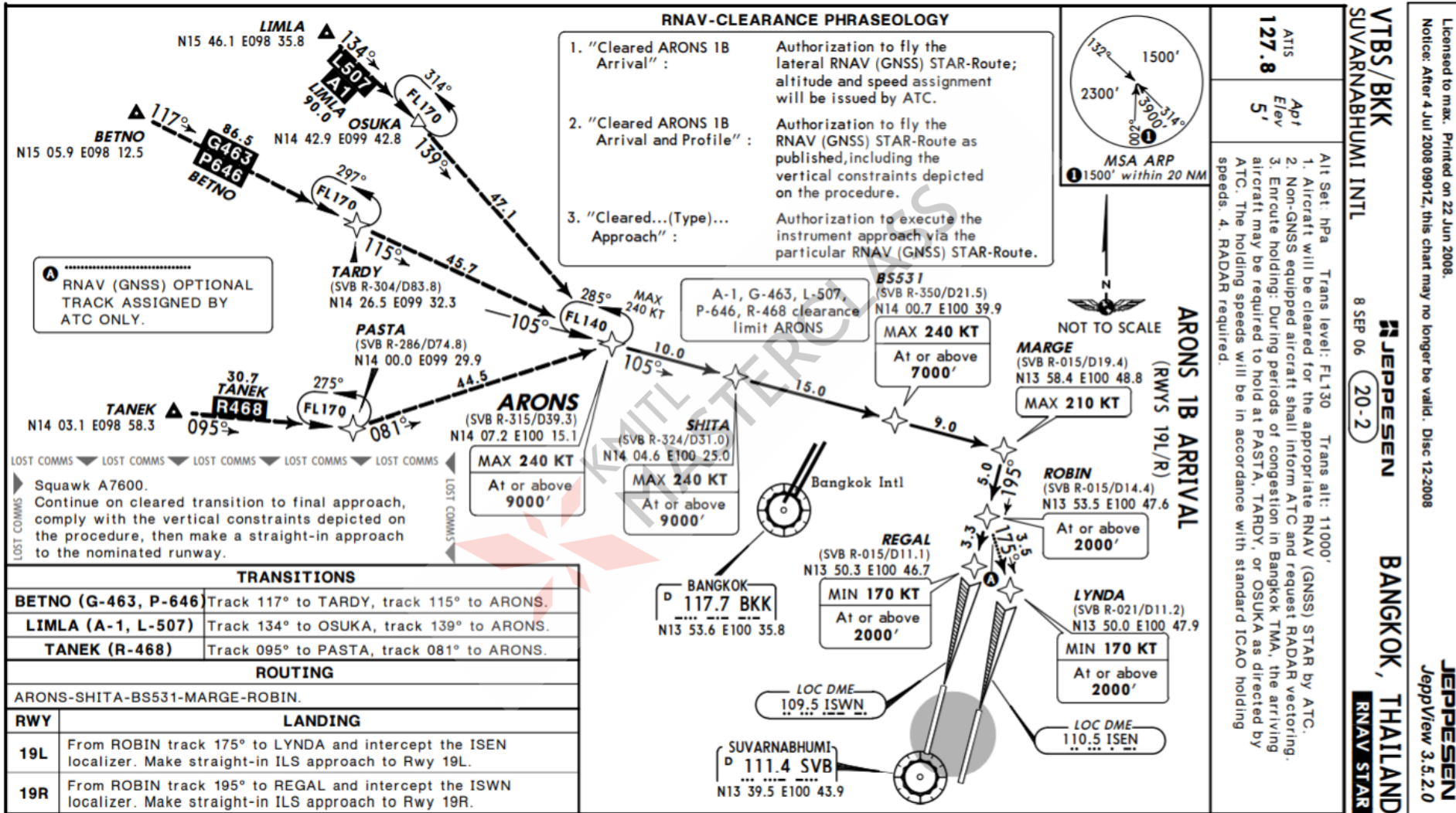
IFR Charts

- ▶ No visual reference
- ▶ Rely on internal or external NavAids
- ▶ IFR Charts contain 'waypoints' or 'fixes'

Types of IFR Charts

- ▶ En-route, low-altitude, high-altitude charts
- ▶ Standard Terminal Arrival (STAR) charts
- ▶ Standard Instrument Departure (SID) charts

Arrival (STAR)



Licensed to max. Printed on 22 Jun 2008.
 Notice: After 4 Jul 2008 0901Z, this chart may no longer be valid. Disc-12-2008

JEPPESEN
JeppView 3.5.2.0

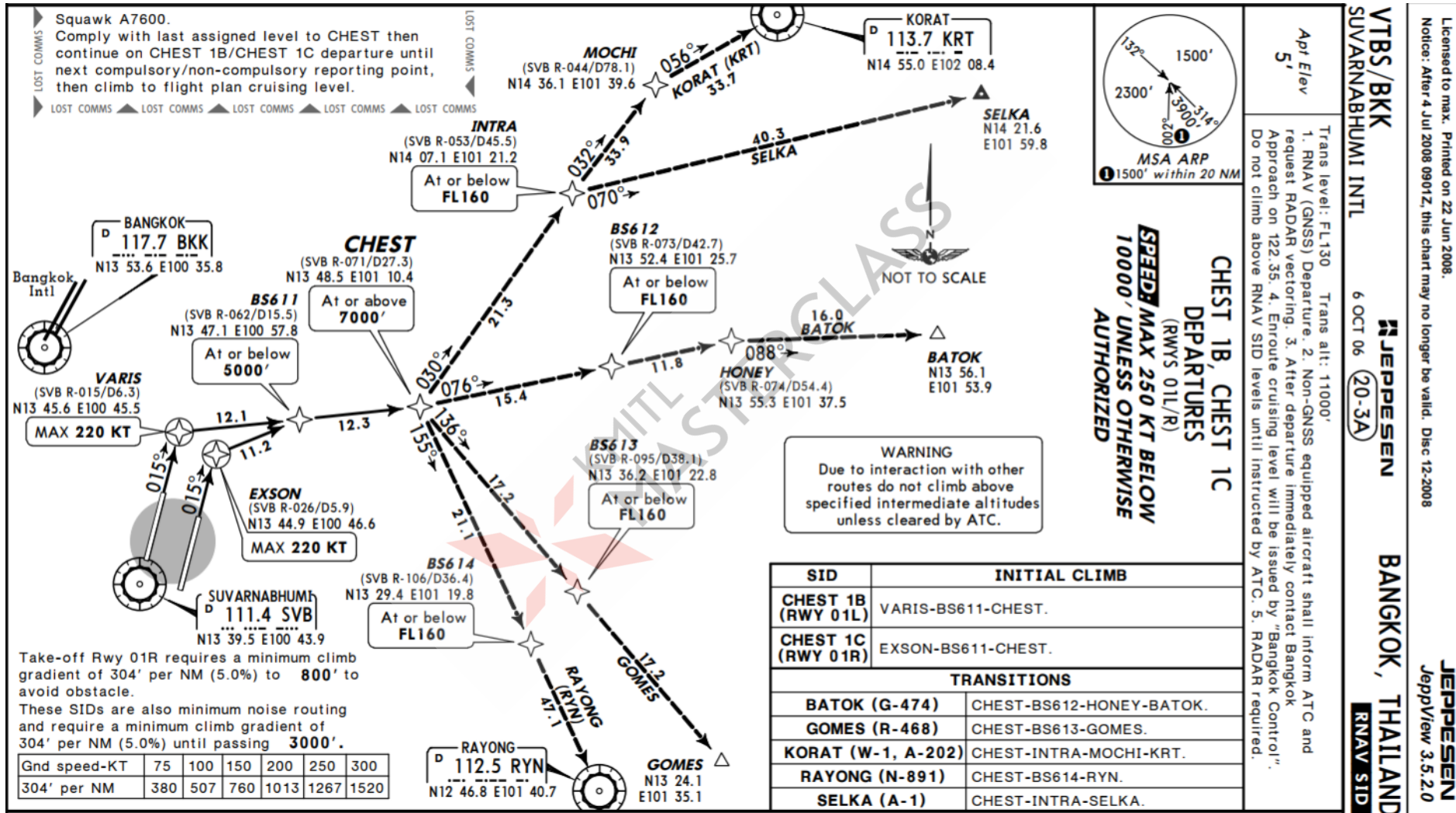
VTBS/BKK
SUVARNABHUMI INTL
 8 SEP 06 **(20-2)**
JEPPESEN
BANGKOK, THAILAND
RNAV STAR

ARONS 1B ARRIVAL
 (RWYS 19L/R)

Alt Set: hPa Trans level: FL130 Trans alt: 11000'

1. Aircraft will be cleared for the appropriate RNAV (GNSS) STAR by ATC.
 2. Non-GNSS equipped aircraft shall inform ATC and request RADAR vectoring.
 3. Enroute holding: During periods of congestion in Bangkok TMA, the arriving aircraft may be required to hold at PASTA, TARDY, or OSUKA as directed by ATC. The holding speeds will be in accordance with standard ICAO holding speeds.
 4. RADAR required.

Departure (SID)



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 Notice: After 4 Jul 2008 0901Z, this chart may no longer be valid. Disc 12-2008.

VTBS/BKK
 SUVARNABHUMI INTL

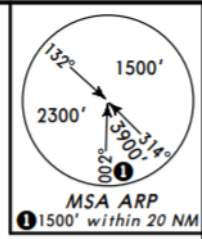
JEPPESSEN
 6 OCT 06 (20-3A)

BANGKOK, THAILAND
 RNAV SID

Apt Elev
 5'

Trans level: FL130 Trans alt: 11000'

1. RNAV (GNSS) Departure. 2. Non-GNSS equipped aircraft shall inform ATC and request RADAR vectoring. 3. After departure immediately contact Bangkok Approach on 122.35. 4. Enroute cruising level will be issued by "Bangkok Control". Do not climb above RNAV SID levels until instructed by ATC. 5. RADAR required.



CHEST 1B, CHEST 1C
 DEPARTURES
 (RWYS 01L/R)
SPEEDS MAX 250 KT BELOW 10000' UNLESS OTHERWISE AUTHORIZED



Sources of charts

- ▶ Jeppesen

- ▶ <http://www.jeppesen.com/documents/aviation/business/ifr-paper-services/glossary-legends.pdf>

- ▶ CAAT

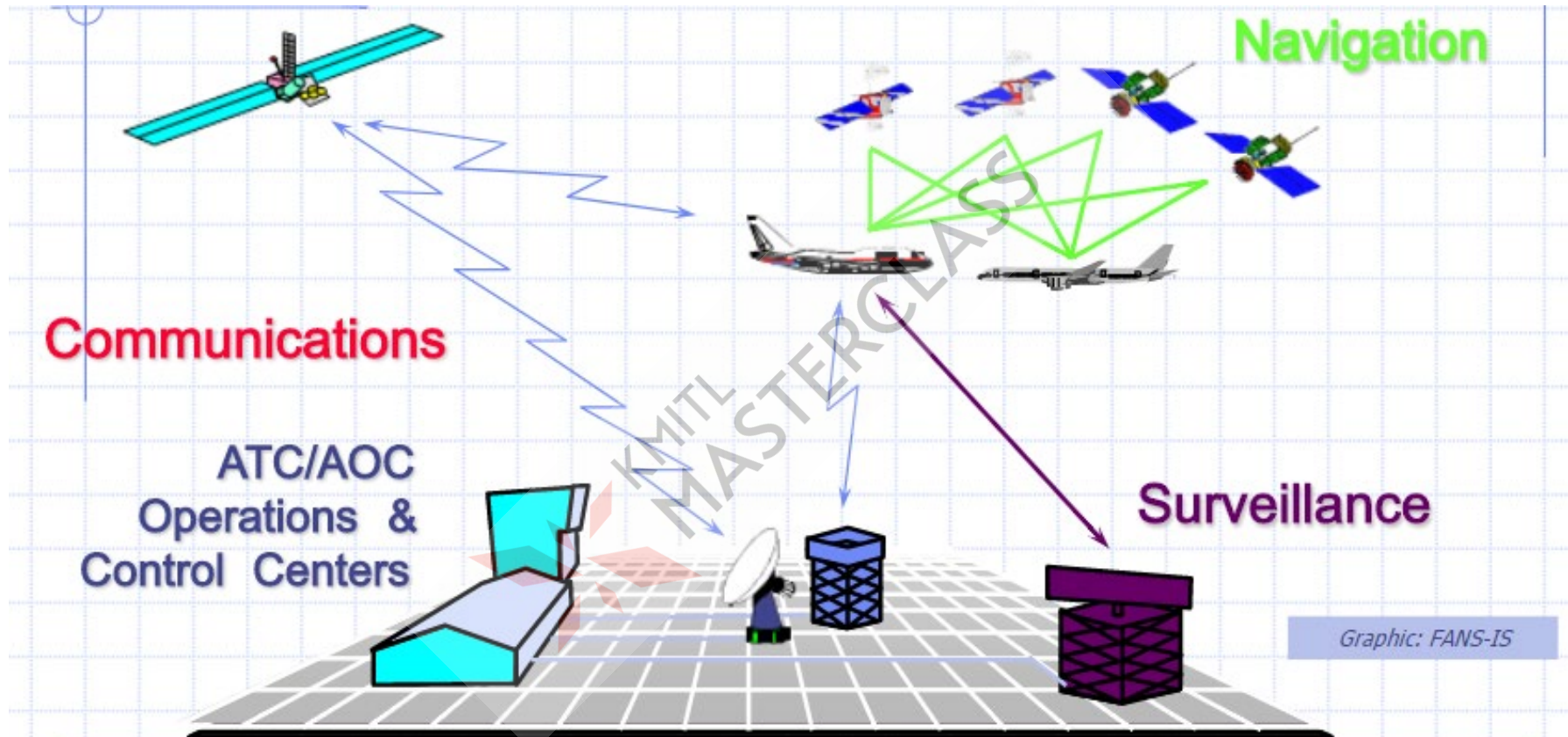
- ▶ https://ais.caat.or.th/wp-content/uploads/2016/12/GEN-3.2-Aeronautical-charts_26_.pdf

- ▶ <http://www.aisthai.aviation.go.th/>



CNS

Communication, Navigation, Surveillance



Communication is a cornerstone of Air Traffic Management, as are Navigation & Surveillance

Communication, Navigation, Surveillance

Communications:

- Voice communication system via UHF, VHF radio and Aeronautical Fixed Telecommunication Network (AFTN)

Navigation Aids or Nav aids → support pilots in navigating and landing with accuracy.

- NDB (Non-Directional Beacon)
- VOR (Very high frequency Omni-Directional Radio Range)
- DME (Distance Measuring Equipment)
- ILS (Instrument Landing System)

Surveillance system → coordinates, altitude, and velocity of aircraft

- **Primary Surveillance Radar (PSR)** installed within the Approach Control are with a coverage of 80-nautical mile radius around airports.
 - Chiang Mai, Phitsanulok, Hua Hin, Phuket, and Bangkok
- **Secondary Surveillance Radar (SSR)** systems used to assist Area Control and provide coverage of 250-nautical mile radius around airports.
 - Chiang Mai, Ubon Ratchathani, Surat Thani and Bangkok

Related Agencies in Aviation Industry

Regulators



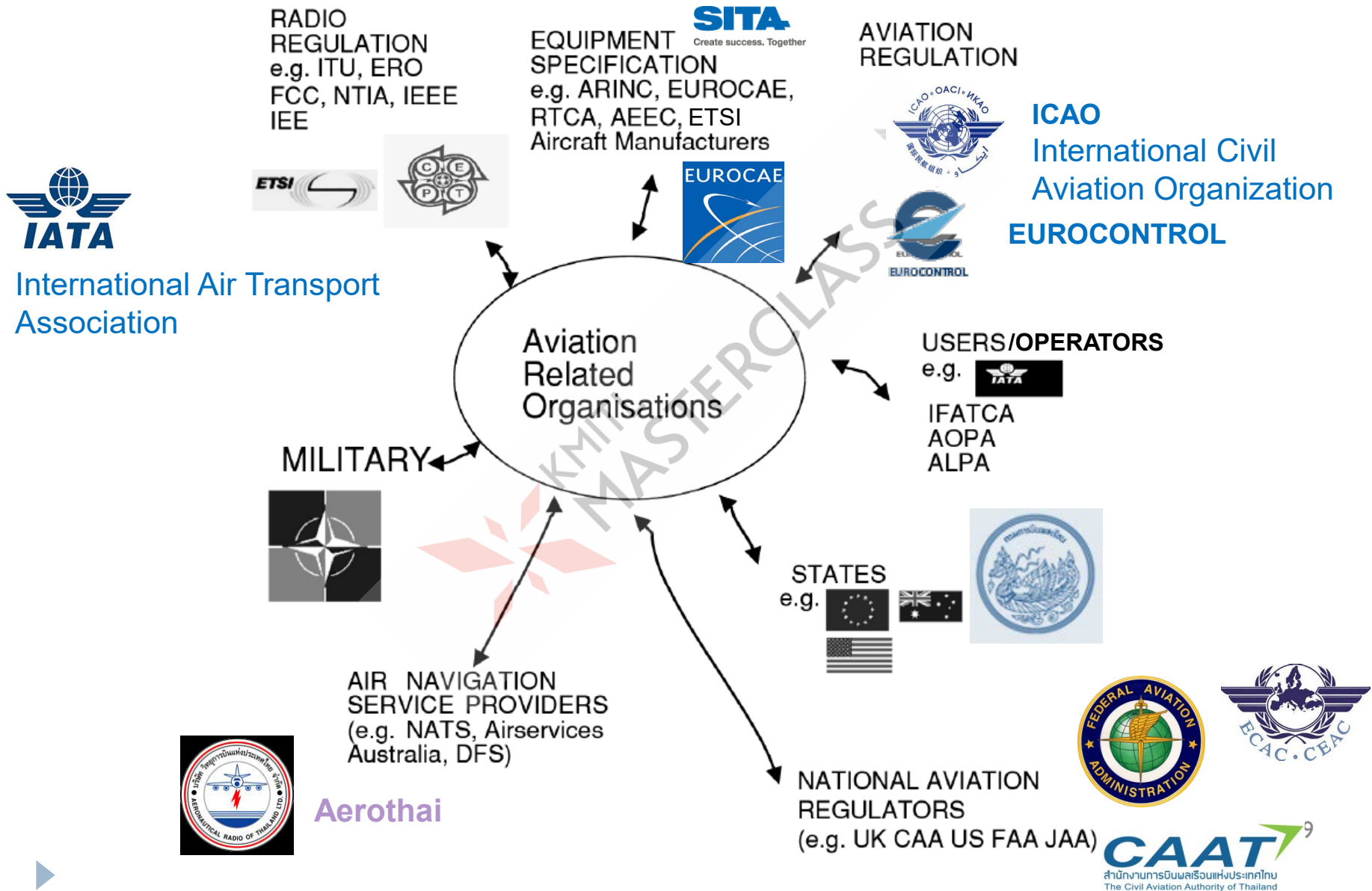
Operators



Airlines

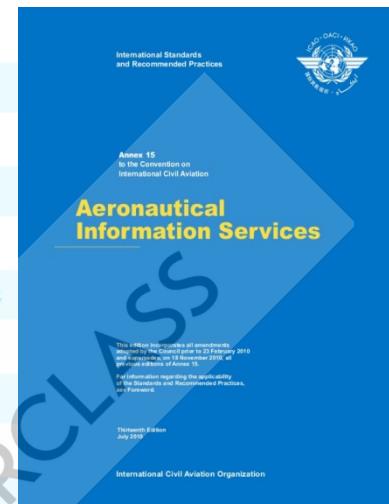


(Overall) Aviation-related organizations



International Civil Aviation Organization (ICAO)

Annex 1	Personnel Licensing
Annex 2	Rules of the Air
Annex 3	Meteorological Service for International Air Navigation
→ Annex 4	Aeronautical Charts
Annex 5	Units of Measurement to be Used in Air and Ground Operations
Annex 6	Operation of Aircraft
Annex 7	Aircraft Nationality and Registration Marks
Annex 8	Airworthiness of Aircraft
Annex 9	Facilitation
→ Annex 10	Aeronautical Telecommunications
Annex 11	Air Traffic Services
Annex 12	Search and Rescue
Annex 13	Aircraft Accident and Incident Investigation
Annex 14	Aerodromes
Annex 15	Aeronautical Information Services
Annex 16	Environmental Protection
Annex 17	Security: Safeguarding International Civil Aviation Against Acts of Unlawful Interference
Annex 18	The Safe Transport of Dangerous Goods by Air
Annex 19	Safety Management



ICAO Annex 10

Volume I: Radio Navigation Aids.

Volume II: Communication Procedures including those with PANS status.

Volume III: Communication Systems
Part I: Digital Data Communication Systems and
Part II: Voice Communications Systems.

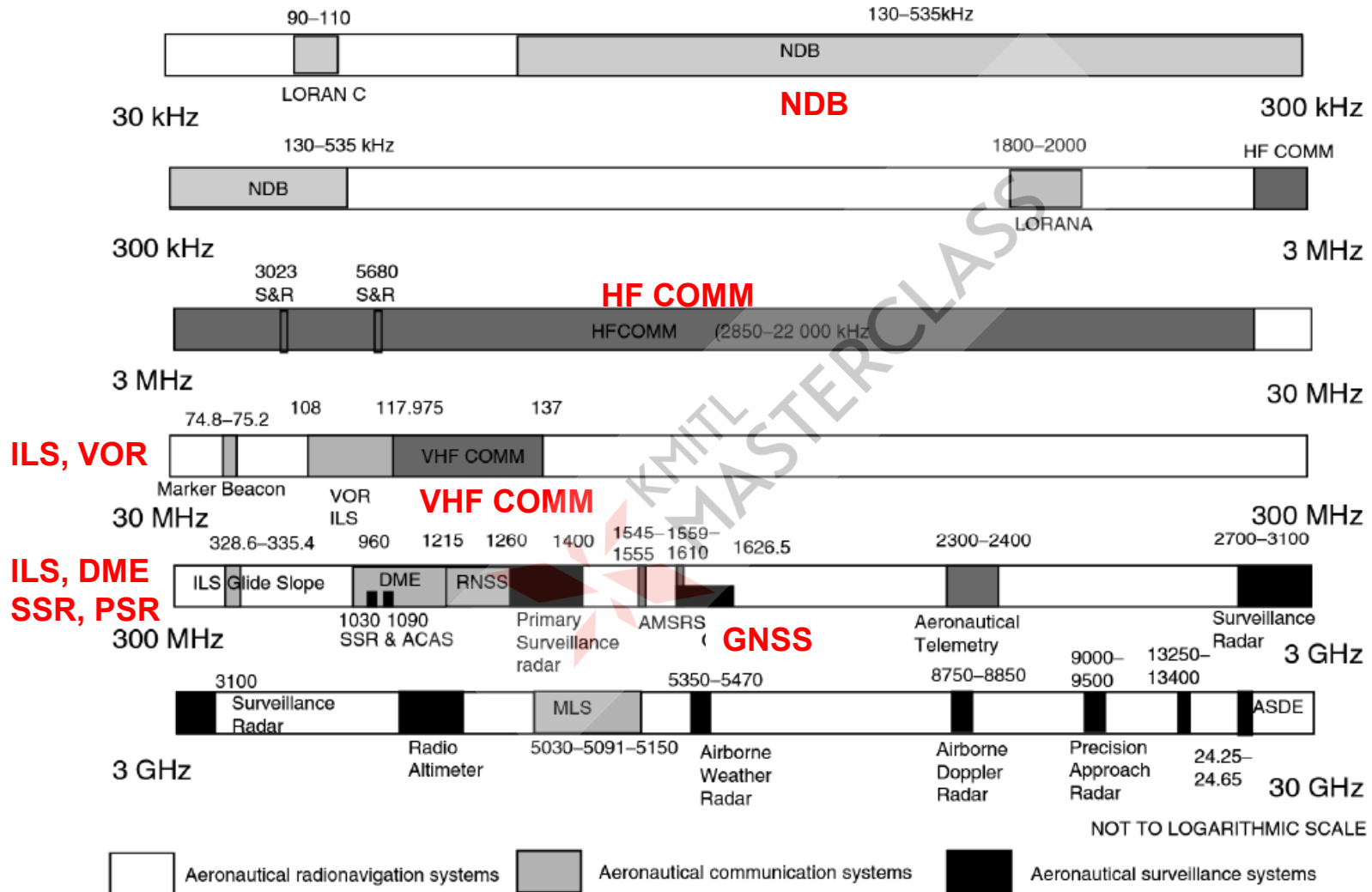
Volume IV: Surveillance Radar and Collision Avoidance Systems

Volume V: Aeronautical Radio Frequency Spectrum Utilization.

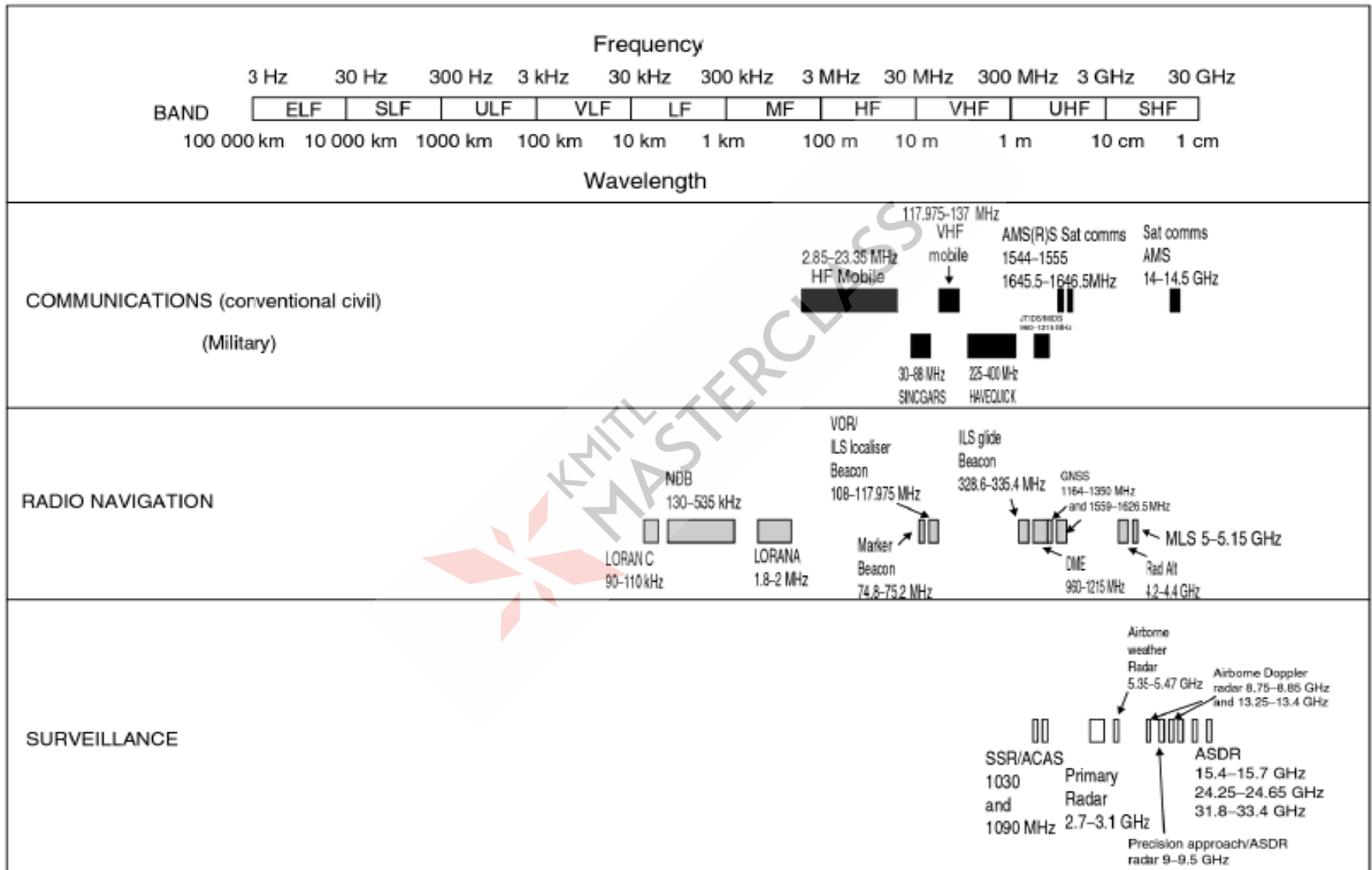


Aeronautical Commun. Spectrum

AERONAUTICAL COMMUNICATIONS SPECTRUM (MAJOR ALLOCATIONS)



Aeronautical radio spectrum



Radio frequencies at VTBS

Communication

Service designation	Call sign	Frequency	Hours of operation	Remarks
1	2	3	4	5
APP	Bangkok Approach	122.35 MHz / 262.5 MHz 124.35 MHz / 262.5 MHz 125.2 MHz / 262.5 MHz 121.7 MHz / 262.5 MHz 125.8 MHz ⁽²⁾ 121.5 MHz ⁽¹⁾ / 243.0 MHz ⁽¹⁾	H24	(1) Emergency frequency (2) Clearance delivery for aircraft departing to adjacent aerodromes and helicopters operating within BKK CTR (3) For RWY 01R/19L (4) For RWY 01L/19R
APP	Suvarnabhumi Departure	119.25 MHz		
ARR	Suvarnabhumi Arrival	133.6 MHz 126.3 MHz 133.4 MHz 121.5 MHz		
TWR	Suvarnabhumi Tower	118.2 MHz ⁽³⁾ / 274.5 MHz 119.0 MHz ⁽⁴⁾ 121.5 MHz ⁽¹⁾ / 243.0 MHz ⁽¹⁾		
SMC	Suvarnabhumi Ground	121.65 MHz / 275.8 MHz 121.75 MHz 121.95 MHz		
ATIS	Suvarnabhumi Airport	127.8 MHz / 278.6 MHz		D-ATIS Synthesis Voice Broadcast

East rwy
West rwy

East apron
Main apron
West apron

Navigation

1	2	3	4	5	6	7
DVOR/DME	SVB	111.4 MHz CH51X	H24	13 39 32.5 N 100 43 53.2 E	RWY01L/19R and RWY01R/19L ILS LOC coverage expanded service volume up to 25 DME altitude not below 2 500 ft AMSL.	
ILS CAT II LOC/DME RWY 01L GP	I-SWS	109.1 MHz CH28X 331.4 MHz		13 42 22.3 N 100 44 37.8 E 13 40 27.8 N 100 44 03.6 E		
ILS CAT II LOC/DME RWY 19R GP	I-SWN	109.5 MHz CH32X 332.6 MHz		13 40 07.5 N 100 44 02.4 E 13 42 03.9 N 100 44 28.9 E		
ILS CAT II LOC/DME RWY 01R GP	I-SES	110.1 MHz CH38X 334.4 MHz		13 41 39.3 N 100 45 42.1 E 13 39 33.4 N 100 45 13.1 E		
ILS CAT II LOC/DME RWY 19L GP	I-SEN	110.5 MHz CH42X 329.6 MHz		13 39 15.0 N 100 45 04.2 E 13 41 19.0 N 100 45 40.9 E		

ATC Clearance

Frequency	Outbound routes
120.8 MHz	A464 (SOUTHBOUND), G458, M751, W19, W31
133.8 MHz	A1 (EASTBOUND), A202, W1
135.8 MHz	N891, G474, R468 (EASTBOUND)
128.7 MHz	A1/L507, A464 (NORTHBOUND), B346, G463/P646, R468 (WESTBOUND), R474, W9, W21

Important Information for Flights

- ▶ **ATIS: Automatic Terminal Information System**
 - ▶ Voice
 - ▶ Data
- ▶ **NOTAM: Notice to Airmen**



Automatic Terminal Information System (ATIS)

- ▶ Name of aerodrome; arrival and/or departure indicator;
- ▶ Contract type, if communication is via D-ATIS;
- ▶ Time of observation, if appropriate;
- ▶ Type of approach(es) to be expected;
- ▶ The runway(s) in use; status of arresting system constituting a potential hazard, significant runway surface conditions and, if appropriate, braking action;

- ▶ Local weather conditions:
 - ▶ wind direction and speed,
 - ▶ visibility and, when applicable, RVR; present weather;
 - ▶ air temperature;
 - ▶ dew point temperature;

- ▶ cloud below 1 500 m (5 000 ft) or below the highest minimum sector altitude, whichever is greater; cumulonimbus; if the sky is obscured, vertical visibility when available;
- ▶ altimeter setting(s);

ATIS Example

- ▶ On tuning to an ATIS frequency, a pilot might hear:
 - ▶ *Vancouver International information Bravo one three five five Zulu weather.*
 - ▶ *Wind three zero zero at eight, visibility five.*
 - ▶ *Five hundred few, one thousand two hundred scattered, ceiling three thousand overcast, temperature one five, dew-point eight.*
 - ▶ *Altimeter two niner eight seven. IFR approach is ILS or visual, runway two six left and runway two six right. Simultaneous parallel ILS approaches in use. Departures, runway two six left.*
 - ▶ *GPS approaches available.*
 - ▶ *VFR aircraft say direction of flight. All aircraft read back all hold short instructions. Advise controller on initial contact that you have Bravo.*



NOTAM

- ▶ **A Notice to Airmen (NOTAM or NoTAM)**
- ▶ a notice filed with an aviation authority to alert aircraft pilots of potential hazards along a flight route or at a location that could affect the safety of the flight
 - ▶ hazards such as air shows, parachute jumps, kite flying, lasers, rocket launches, etc.
 - ▶ flights by important people such as heads of state (sometimes referred to as [temporary flight restrictions](#), TFRs)
 - ▶ closed runways
 - ▶ inoperable radio navigational aids
 - ▶ military exercises with resulting airspace restrictions
 - ▶ inoperable lights on tall obstructions
 - ▶ temporary erection of obstacles near airfields (e.g., cranes)
 - ▶ passage of flocks of birds through airspace (a NOTAM in this category is known as a BIRDTAM)
 - ▶ Etc.
- ▶ Normally exchanged via **Aeronautical Fixed Telecommunication Network (AFTN)**

ICAO NOTAMs

- ▶ **First line** NOTAM identification (series, sequence number, and year of issue), the type of operation (**NEW, REPLACE, or CANCEL**)
- ▶ **"Q" line** holds (basic-remove) information about who the NOTAM affects along with a basic NOTAM description. This line can be encoded/decoded from tables defined by ICAO. This allows NOTAMs to be displayed electronically
- ▶ **"A" line** The affected aerodrome or FIR for the NOTAM. The area of influence of the NOTAM can be several hundreds of kilometres away from the origin
- ▶ **"B" line** The start date and time (YY/MM/DD), Universal Co-ordinated Time (GMT)
- ▶ **"C" line** The finish date and time of the NOTAM
- ▶ **"D" line** (if any) miscellaneous diurnal time for the NOTAM if the hours of effect are < 24 hours a day, e.g., parachute dropping exercises (may repeat many days.)
- ▶ **"E" line** The full NOTAM description. It is in English but heavily abbreviated. These abbreviations can be encoded/decoded by tables defined by ICAO.
- ▶ When present, **"F" and "G" lines** detail the height restrictions of the NOTAM. Typically SFC means surface height or ground level and UNL is unlimited height. Other heights are given in feet or flight level or a combination of the two.

NOTAM example

A3084/14 NOTAMN

Q) VTBB/QMNLX/IV/NBO/A/000/999/1355N10036E005

A) VTBD

B) 1408210300 C) 1408220400

D) DLY 0300-0400

E) RTAF APRON BTN TWY S AND TWY V OPR BUT CTN ADVISED
DUE TO MIL OPR RMK/ACFT TAKE CTN WHILE TAXIING
CREATED: 17 Aug 2014 01:31:00 SOURCE: VTBDYNYX

**A3084/14 - RTAF APRON BTN TWY S AND TWY V OPR BUT CTN
ADVISED DUE TO MIL OPR RMK/ACFT TAKE CTN WHILE TAXIING.
DLY 0300-0400, 21 AUG 03:00 2014 UNTIL 22AUG 04:00 2014.
CREATED: 17 AUG 01:31 2014**

NOTAM example

A3058/14 NOTAMN

Q) VTBB/QICCT/I/NBO/A/000/999/1354N10036E018

A) VTBD

B) 1408150410

C) 1409150330

E) ILS RWY 21R ON TEST, DO NOT USE

CREATED: 15 Aug 2014 04:14:00

SOURCE: VTBDYNYX

**A3058/14 - ILS RWY 21R ON TEST, DO NOT USE. 15 AUG 04:10 2014
UNTIL 15 SEP 03:30 2014.**

References

- <https://www.reference.com/vehicles/four-stroke-engine-work-2ec8d5f1dff0c977>
- “Private Pilot,” Jeppesen
- www.nasa.gov
- <http://www.nappf.com/>
- <http://www.flightlearnings.com/>
- <http://slideplayer.com/slide/4741614/>
- <http://www.cfinotebook.net/notebook/national-airspace-system/national-airspace-system>
- Pilot’s Handbook for Aeronautical Knowledge, FAA, 2016.

