

# **Six Meters Propagation Modes**

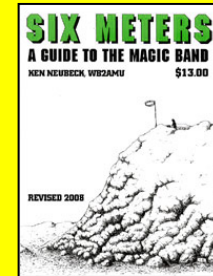
**July 25, 2018**

**Presented by  
Ken Neubeck WB2AMU**

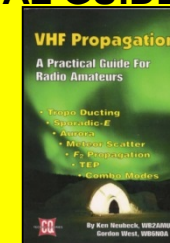
# WB2AMU – Ken Neubeck - biography



**SIX METERS, A GUIDE TO THE MAGIC BAND.** (Author)



**VHF PROPAGATION, A PRACTICAL GUIDE** (co Author)



Was columnist for CQ VHF Magazine until end of 2013.

Regular speaker on Six Meter and VHF topics at club meetings and conventions

## **Why is Six Meters called the “Magic Band”?**

Six Meters is often quiet but at times, Six Meters can be a Kaleidoscope of propagation modes that can easily be observed!

- Sporadic-E (Es)
- Aurora (Au)
- F2
- TEP
- Combination modes (TEP plus Es)

# Possibilities for Six Meter DX in Future

- F2 activity above 28 MHz is on the decline from the peaks of the last three cycles – Cycle 22, 23 and 24
- Cycle 25 is projected to be worse than Cycle 24, which had only a small amount of F2.
- There probably is not going to be any East-West F2 paths during Cycle 25 based on the solar activity projections.
- There will be some TEP paths as F-layer ionization over the equator will require only moderate amounts of ionization.
- However, the main propagation mode will be multiple-hop Sporadic-E which occurs during summer season of May through early August.

# Six Meter Sporadic-E

- With F2 on Six unlikely in the future, Sporadic-E will be the primary means of working DX on Six Meters for the next several years.
- Sporadic-E is the bread and butter propagation mode that appears on Six Meters.
- It is a sky wave propagation mode that is observed on Six Meters, particularly during the summer months (May through August)
- Sporadic-E makes the Six Meter band interesting
- Six Meters is the borderline band between HF and VHF and is generally quiet in terms of propagation, so when Sporadic-E occurs, the band becomes exciting!

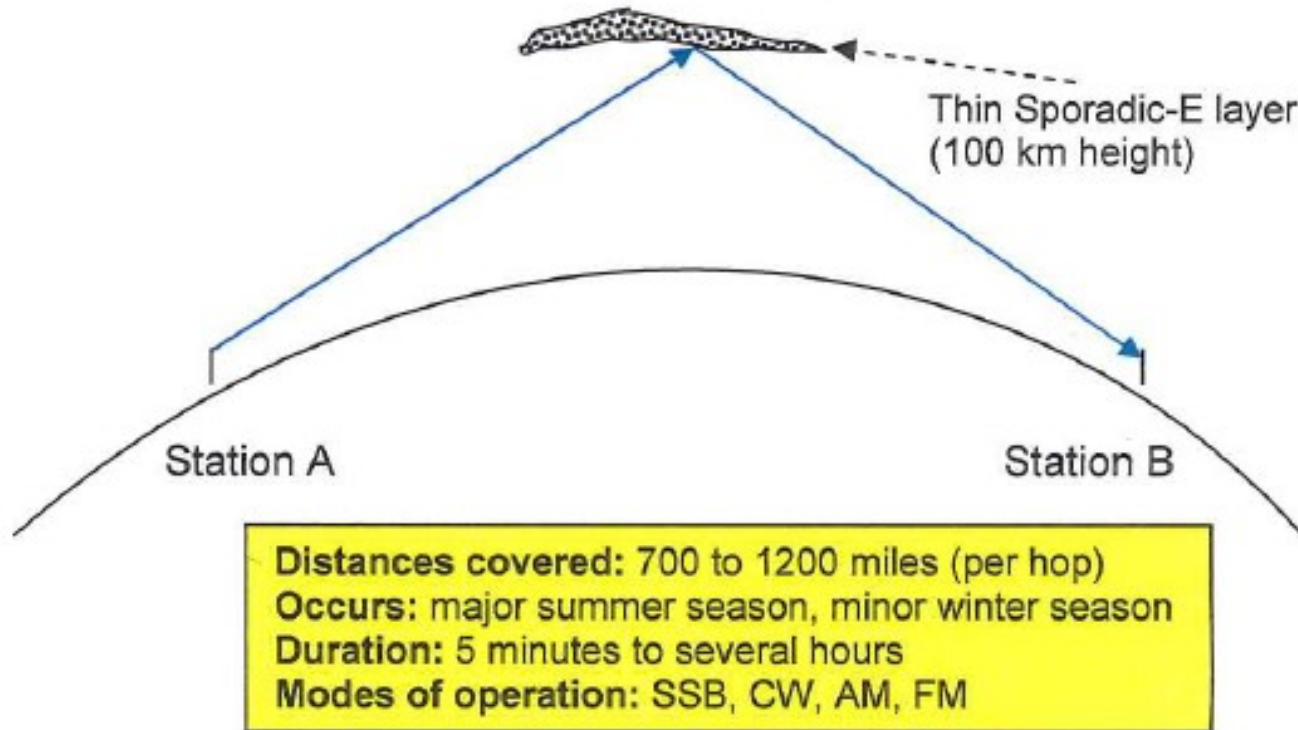
# Sporadic-E Facts & Characteristics

- It was first discovered by radio amateurs in 1935 on the Five Meter band.
- Formations occur at 100 km (70 miles) above earth in E-region of ionosphere.
- Formations can reflect radio waves as low as 28 MHz up to 200 MHz as the density of the formation increases.
- Formations lasts for as little as five minutes to as much as several hours. Fading may occur due to non-uniform density.
- Signals can get very loud at times, even with low power!
- Major occurrence during summer months (May – June).
- Minor winter season (November – January).

## **Sporadic-E Facts & Characteristics (cont)**

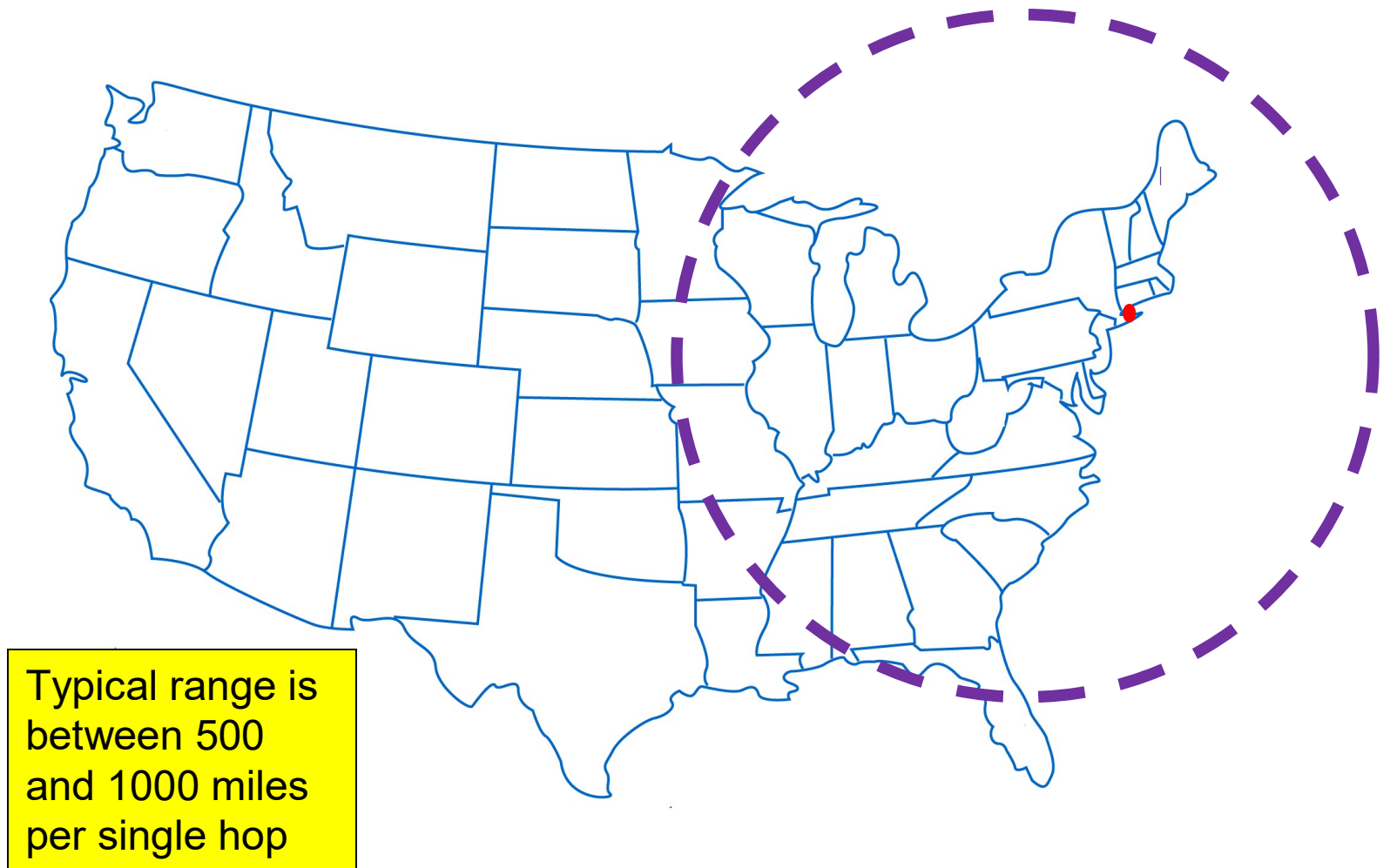
- Formations consists of ions that are iron, magnesium, nickel, silicon and other metals (determined by rocket probes).
- Summer season is significant with the presence of oxygen ions in the E-region as the result of solar radiation.
- During summer season, multiple formations can occur simultaneously, leading into long-range paths for DX contacts on the Six Meter band.
- As formations get denser, higher frequencies can be reflected. At this point, the skip appears shorter in distance (less than 800 miles) on Six Meters and at that point Two Meter Sporadic-E may occur on occasion during the summer.
- Sporadic-E is basically independent of the solar cycle (little variation year-to-year of the solar cycle).

# Six Meter Single-Hop Sporadic-E Propagation





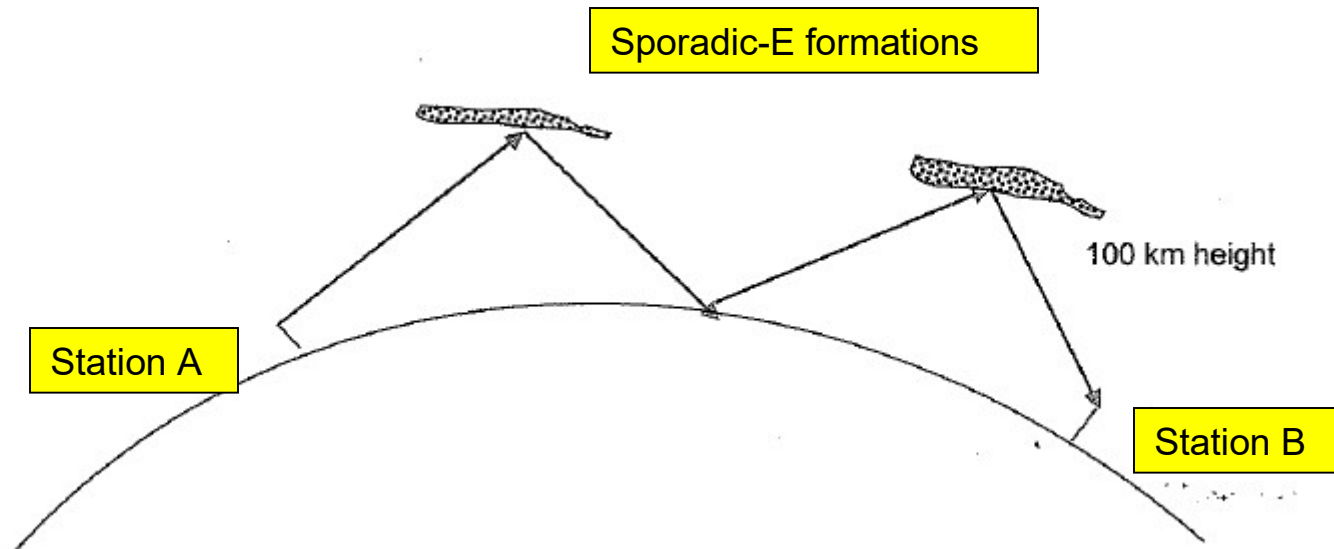
# 50 MHz Single-hop Sporadic-E range from Long Island



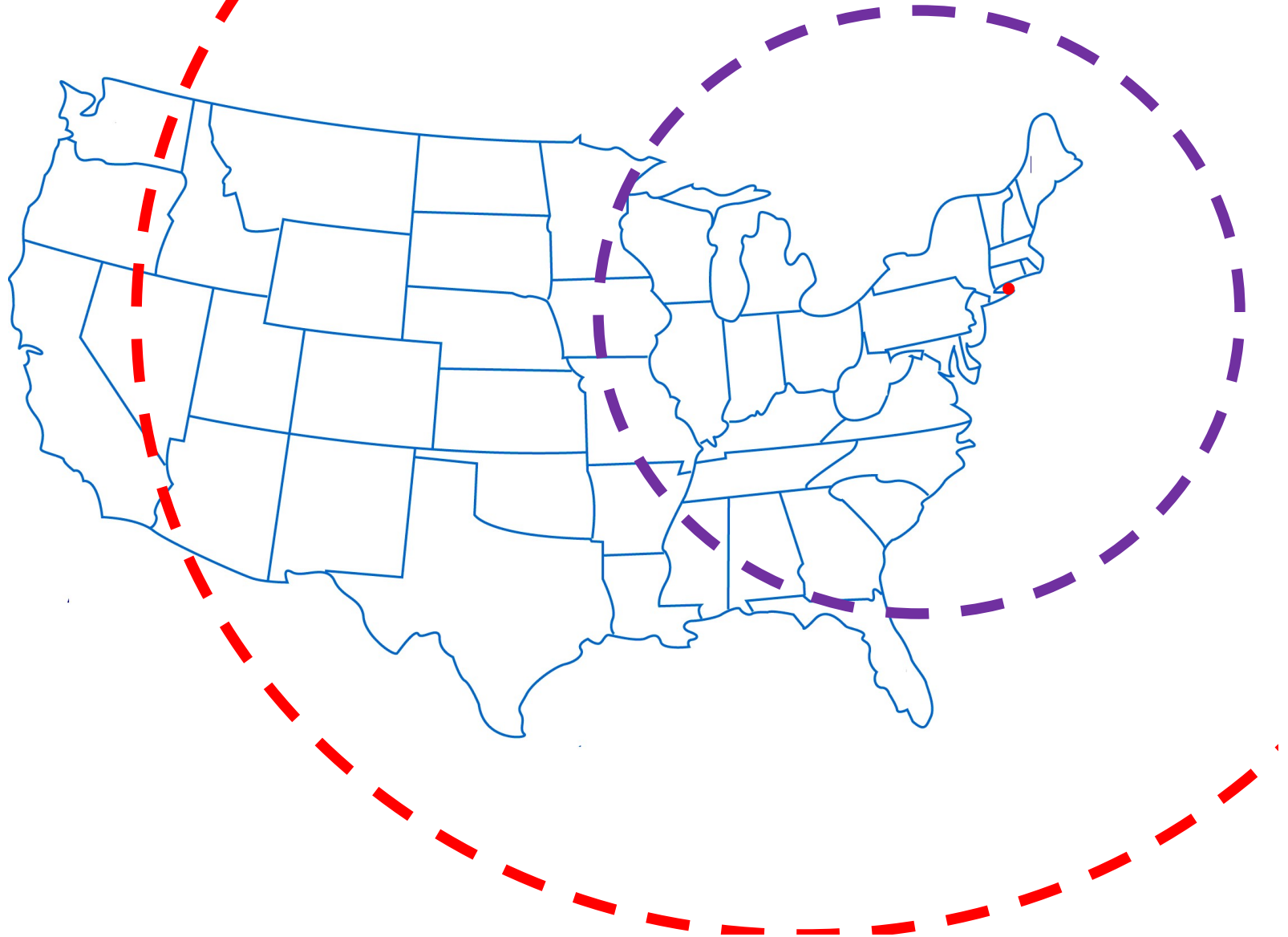
# Working Sporadic-E on Six Meters

- The VUCC award is reasonably easy to obtain on Six Meters during one or two summer season of Sporadic-E activity.
- This requires confirmation of 100 grid squares worked on Six Meters.
- A grid square aligns with the geomagnetic division lines (2 degrees long by 1 degree high).
- We are located in FN30 (most of Long Island)
- From FN30, it is reasonably possible to work most of the EM grid square field.

# Double-Hop Six Meter Sporadic-E Propagation



# 50 MHz Double-hop Sporadic-E range from Long Island

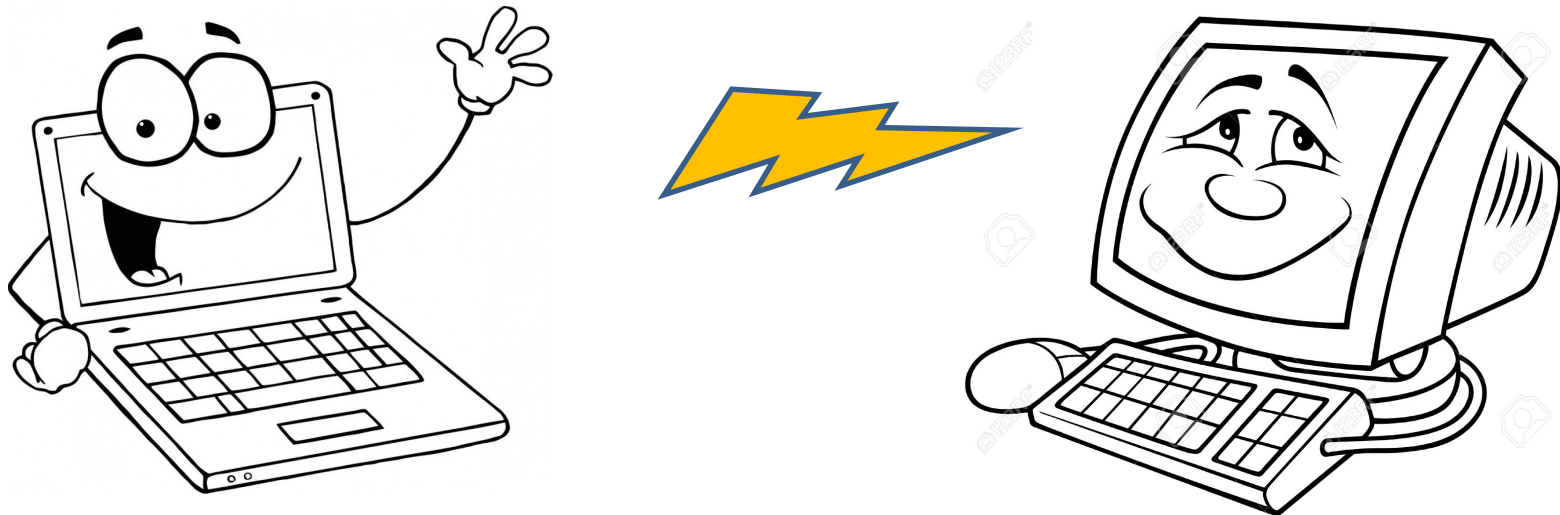


## Summers of 2017 and 2018

- Six Meters has almost become exclusively the digital mode band and not the Magic Band as digital modes totally dominated the day-to-day activity of the band. The domination of digital modes over other modes was higher on Six Meters than any other ham radio band.
- Three digital modes are used on the band:
  - JT65 (for Sporadic-E work) 50.313 (not used since 2017)
  - FT-8 (for Sporadic-E work) 50.313 [faster than JT65]
  - MSK144 (for Meteor Scatter work) 50.276

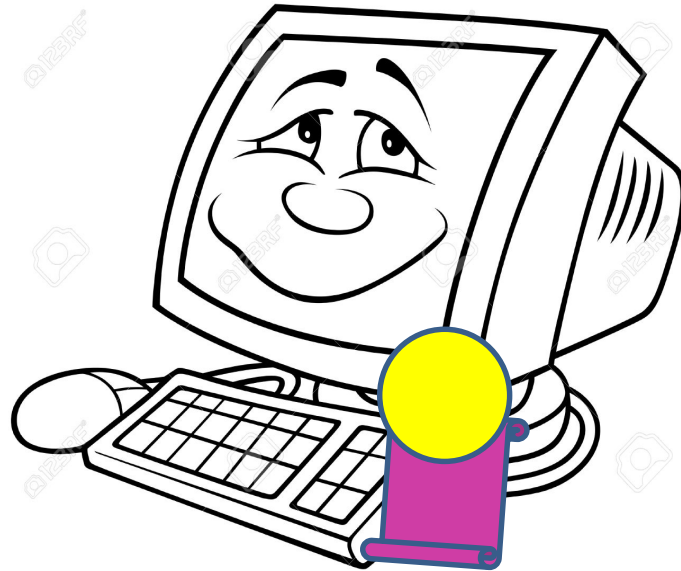
# Six Meters

- Digital activity accounted for over 80 percent of the day-to-day activity on Six Meters during the summer of 2017 and 2018.
- Stations were able to work DX that would have been difficult to work either on CW or SSB. Tones are typically below human hearing of 20 db.



## Six Meter DXCC via FT-8

- Is easier with the advent of digital modes to get DXCC on Six Meters. However, it is really the computer doing the work by “hearing” the signal. No operator skill is required – just a functioning computer hooked up to the radio.
- Give your computer a hug and an award for making the contact!



## Contesting using FT-8

- Currently, it takes 15 seconds for each transmission – takes about two transmission from each station (60 seconds total). SSB during a major band opening could go faster (20 to 40 seconds per contact). This may change.
- Band conditions via weak Sporadic-E could change during the transmission quality.
- FT-8 may not be possible via the aurora mode.



# Multiple-Hop Six Meter Sporadic-E

- It is through multiple-hop Sporadic-E that long-range DX becomes possible (two hops or more) on Six Meters.
- Multiple-hop Sporadic-E can occur anytime on Six Meters between during the summertime Sporadic-E season from May and August, with June and July statistically being the best months.
- During June and July, eastern parts of the US and Canada can work into Europe. Spain, Portugal and the Azores are reasonably possible. Western and Midwest states can work into Japan during June and July as well.
- Typical summer can see five to six transatlantic openings between east coast of US and Canada into Europe. Peak time is June and July. Some summers may be more, some may be less.
- Remember, Sporadic-E is unaffected by the solar cycle, so activity is generally consistent each summer.
- Moderate equipment can be used to work domestic stations and DX stations. Simple beams and 100 Watts will do fine.

# 2014 Transatlantic Six Meter Sporadic-E

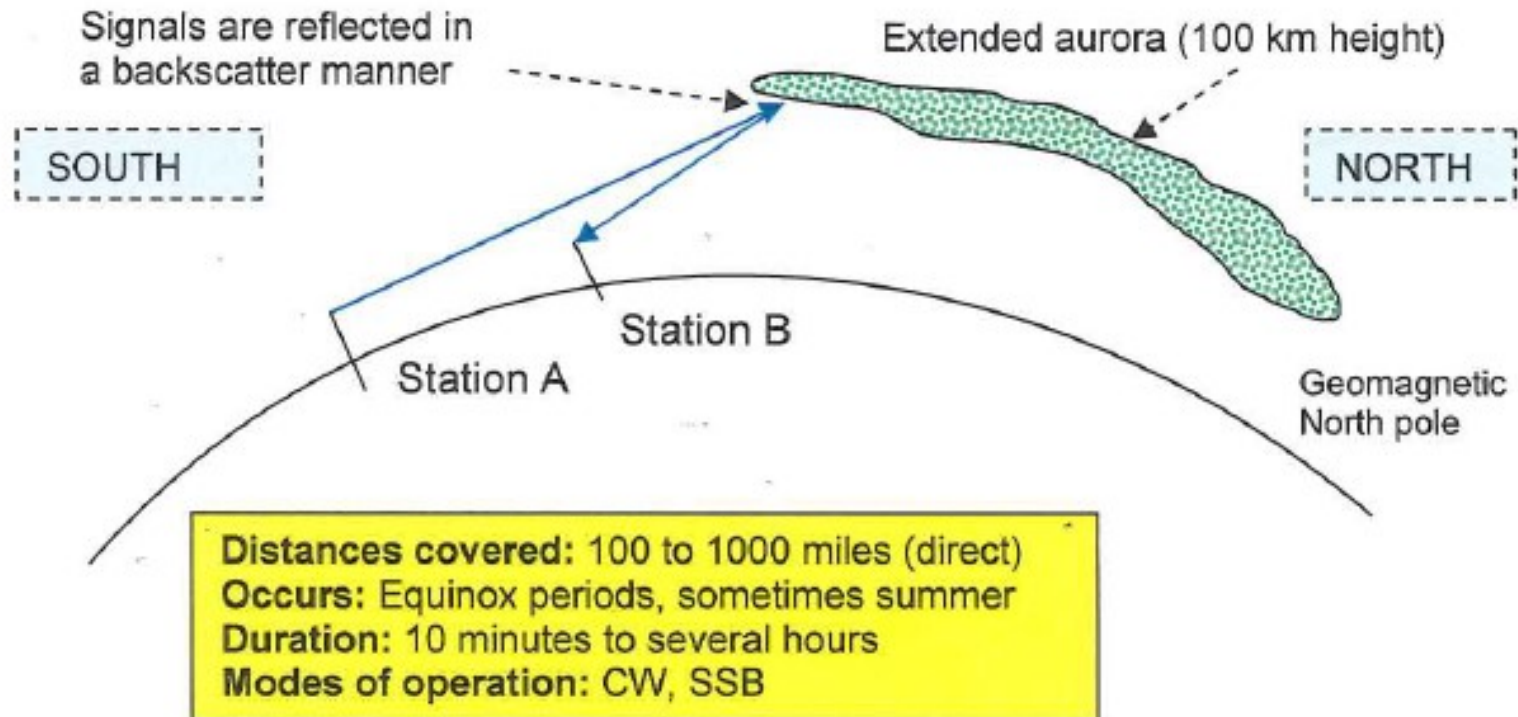
- June 11, 2014 – 1438 to 1519 UTC – East Coast US into Europe
- WB2AMU's mobile setup of 50 Watts and vertical - works S59A & F2DX



# Aurora activity on Six Meters

- A few events were observed during 2015 and 2016 with a few events reaching to mid-latitude levels during this time.
- Cycle has been generally weak with regards to geomagnetic events such as solar flares and CME impact on earth's magnetic field.
- Could still be some increased occurrences of aurora during upcoming spring equinox periods, particularly since the period after the solar peak usually sees more geomagnetic activity.
- This mode is likely to occur occasionally when a CME event occurs.

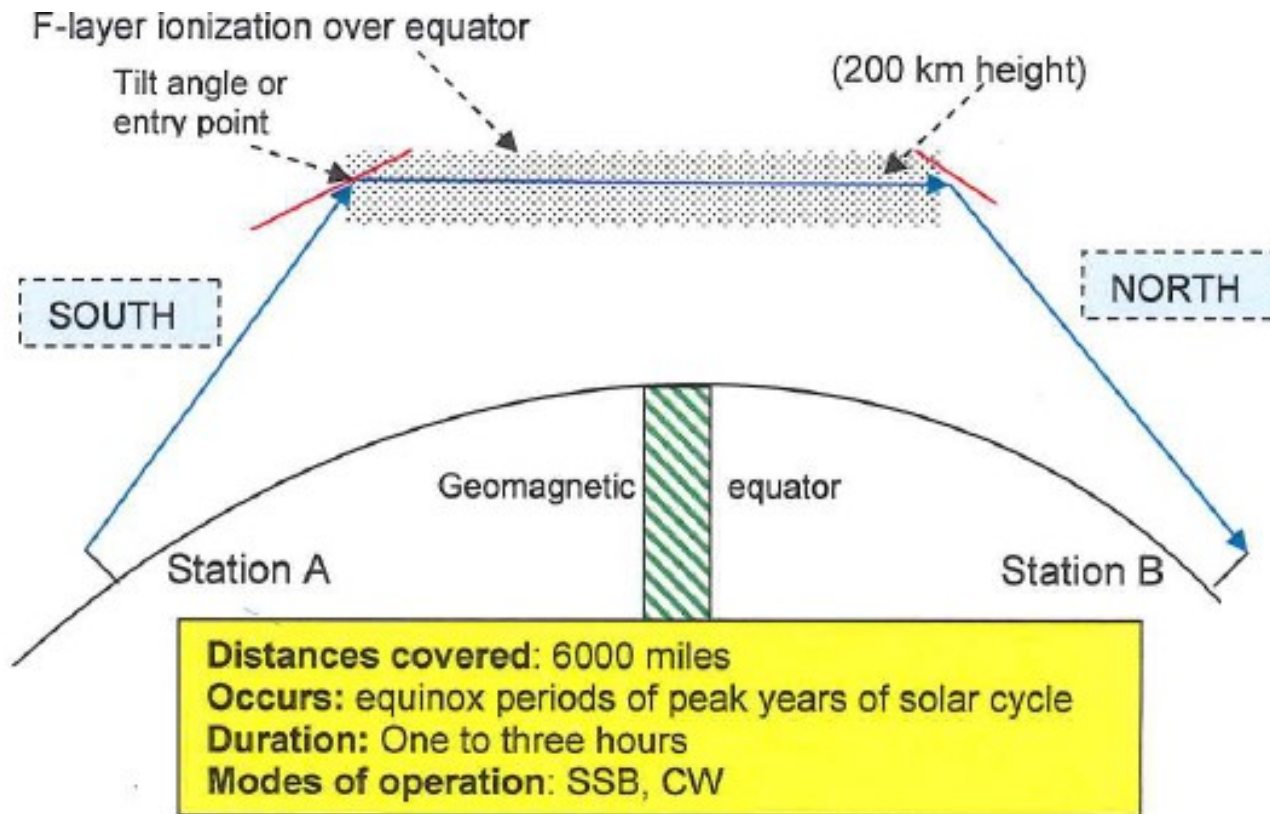
# Six Meter Aurora Propagation



# Transequatorial Propagation (TEP)

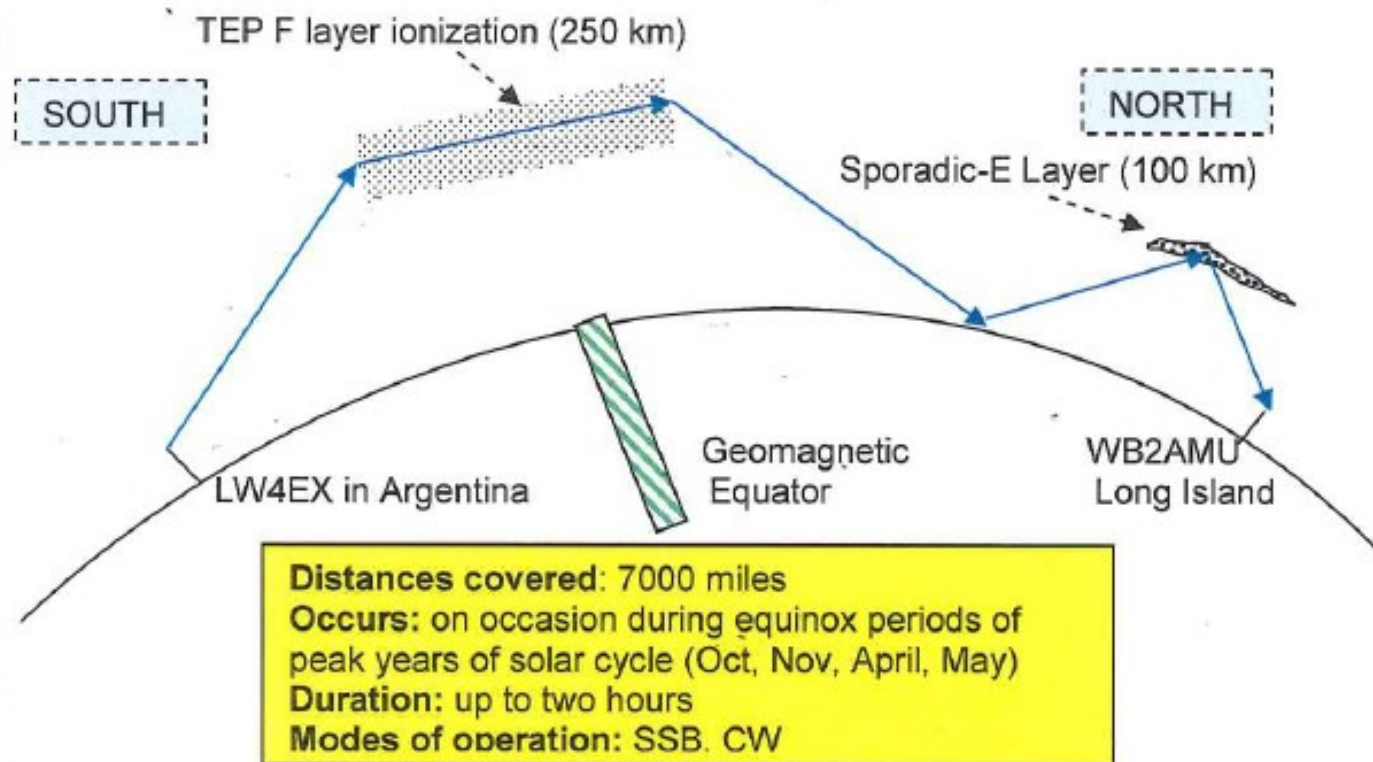
- Even though conventional F2 propagation on Six Meters has may be diminished due to lower solar activity this cycle, solar cycle can be sufficient enough to aid another form of F-layer propagation that forms over the geomagnetic equator – Transequatorial Propagation (TEP)
- Transequatorial Propagation is prevalent during the equinox periods – April/May and October/November.
- Need lesser amount of ionization for the F layer over the equator to be energized in comparison to F2 layer.
- It is generally a late afternoon/early evening occurrence.
- So even though F2 activity has been low for Cycle 24, TEP activity and similar cross-equatorial propagation was present during Cycle 24 up to 2014. Next time period would be around 2020.

# Six Meter Transequatorial (TEP) Propagation



# TEP can combine with Sporadic-E

Event: 10/6/02 @ 2100 UTC; Northeast US into Argentina





# Six Meter TEP plus Sporadic-E (5/12/14)





# Portable Six Meter antennas can be used for all Six Meter propagation modes!



Three element Six Meter Yagi at Field Day site located in Eastern Long Island



Three element Six Meter Yagi at portable location for January VHF Contest on hill 250 feet ASL in Central Long Island

# VHF Contests

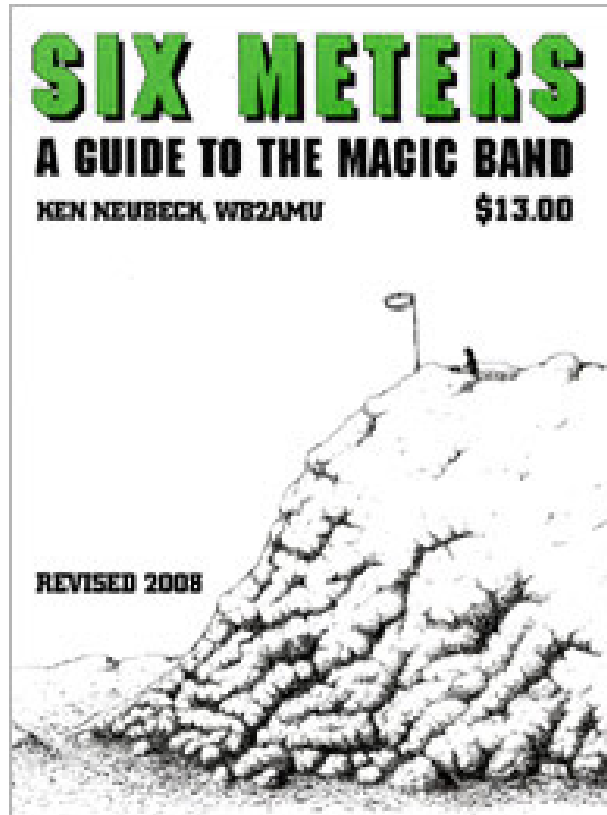
- The three ARRL VHF Contest that are held yearly take place during times of certain propagation modes.
- ARRL January contest: short-duration Six Meter Sporadic-E openings and F2 openings during solar peak years (2002 was last time). Next one is the weekend of January 30<sup>th</sup>.
- ARRL June contest: moderate levels of Six Meter Sporadic-E openings that appear during the contest and on occasion, aurora openings.
- ARRL September contest: tropo openings, rare Six Meter Sporadic-E and rare Six Meter aurora openings.
- CQ WW VHF Contest occurs in July.

# Tips towards working DX on Six Meters

- Monitor the domestic calling frequency of 50.125 MHz and the DX calling frequency of 50.110 MHz for activity. Also, the beacon portion of the band of 50.060 MHz through 50.080 MHz is important.
- Check digital modes of 50.313 MHz for FT-8.
- CW is a very important mode towards working DX. Europeans like to frequent between 50.080 and 50.105 MHz.
- Spotting sites on the Internet such as the [ON4KST.com](http://ON4KST.com) site are extremely helpful where there is an interactive map and chat.
- Even though F2 activity will be diminished significantly on Six Meters, Sporadic-E will make it possible for east coast US stations to work DX in Europe, Africa, South America and North America.

# SIX METERS, A GUIDE TO THE MAGIC BAND

- Written in 1994 because there was not a lot of information about Six Meters at the time. Published by Worldradio. A total of four editions have been published. Last edition is 2008.



Copies available at special price of \$10 each!