

# IMS GLOBALink Voice Services

## Impact of Solar Events on HF Comms

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# Rockwell Collins IMS (Information Management Services) Communications Center Facts –

## *Aircraft Call - We Answer*

- Two facilities providing HF and VHF communications services
  - New York Communications Center (NYC) in Islip, NY
  - San Francisco Communications Center (SFO) in Livermore, CA
- Over 10% of the world oceanic airspace is covered by the NYC and SFO Radio Operators (ROs)
- Combined, both Comm Centers process over 2 million messages each year for aircraft.

Approximately 200,000 messages per month

We have been the HF Voice of the FAA for over 60 years



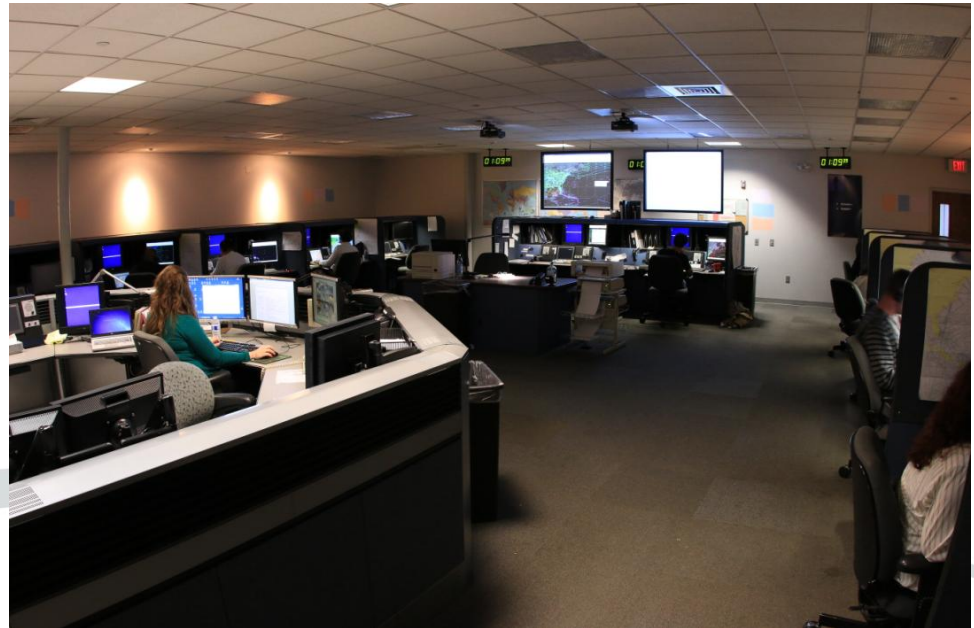
Clearances delivered in less than 3 minutes

Requests and Advisories delivered in less than 5 minutes

With an error rate of less than 1 per million

# Rockwell Collins IMS HF Voice Services

- We operate 7 HF Voice radio sites to cover ATC and AOC communications from the North Pole to South America
- 15 HF data link radio sites compliment our voice services which provides true global coverage
- 100 Radio Operators staff 25 positions and operate 60 HF frequencies and 11 VHF radio nets throughout the contiguous U.S. and all U.S. Oceanic airspace.



# Rockwell Collins IMS HF Voice Services

- Rockwell Collins' air/ground international voice services connect far-reaching corners of the world. The radio operators at these facilities also control remote, high-powered HF radio sites

The air/ground international service is used to:  
Coordinate ground and flight activities—ARTCC's and Airlines can better control and track aircraft, allowing more efficient handling Oceanic and Ground operations



# Rockwell Collins IMS HF Voice Services

- Rockwell Collins' Radio Operators are on duty 24x7. They handle messages by:
  - Sending transcribed messages to any IMS data network service, subscriber, or any International Civil Aviation Organization address, worldwide
  - Establishing a phone patch between aircraft and any ground facility
  - Delivering ground-originated calls to aircraft anywhere in the coverage area



# COMM CENTER FACTS (continued)

- Communications Services
  - HF and VHF ATC air/ground voice communications services for aircraft operating in FAA-controlled oceanic airspace (*safety of flight*)
  - HF and VHF airline operational control (AOC or “Company”) communications for aircraft operators in international airspace
  - VHF air/ground voice communications for AOC messaging and phone patching services in domestic U.S. airspace

# HF RADIO & SELCAL CHECKS

- **NYC Communication Center's LDOC Facilities (non ATC)**
  - (NYC) Riverhead, New York
  - (VVI) Santa Cruz, Bolivia
- **SFO Communication Center's LDOC Facilities (non ATC)**
  - Barrow (Barrow, Alaska)
  - Guam
  - Pacific (Molokai, Hawaii)
  - Dixon (Dixon, California)
  - Hat Yai, Thailand/HDY



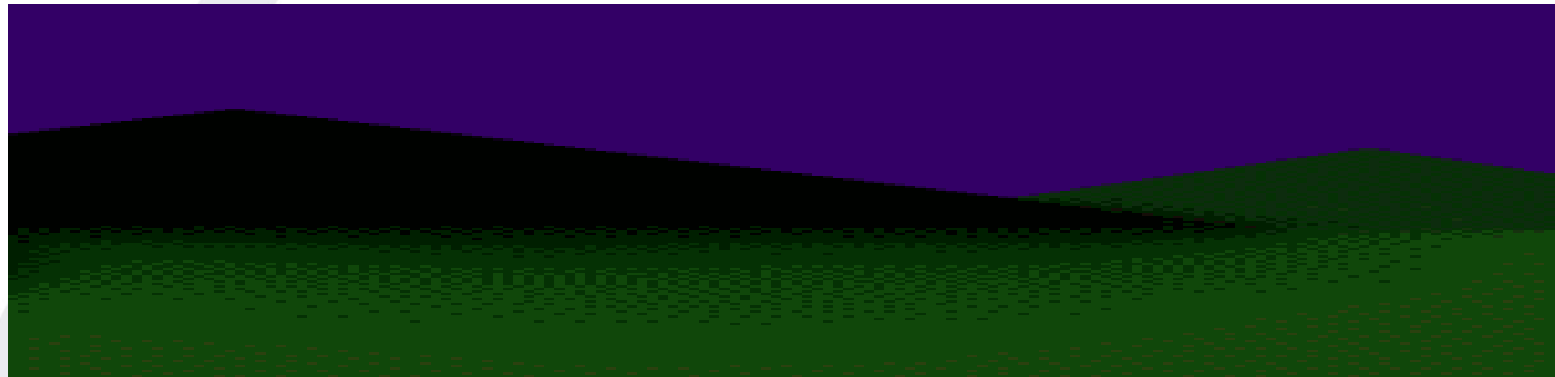
Both the NYC and SFO LDOC Facilities utilize the exact same frequencies

- **21964**
- **17925**
- **13348**
- **11342**
- **8933**
- **6640**
- **3494**



# HF Frequency Propagation – “Follow the Sun”

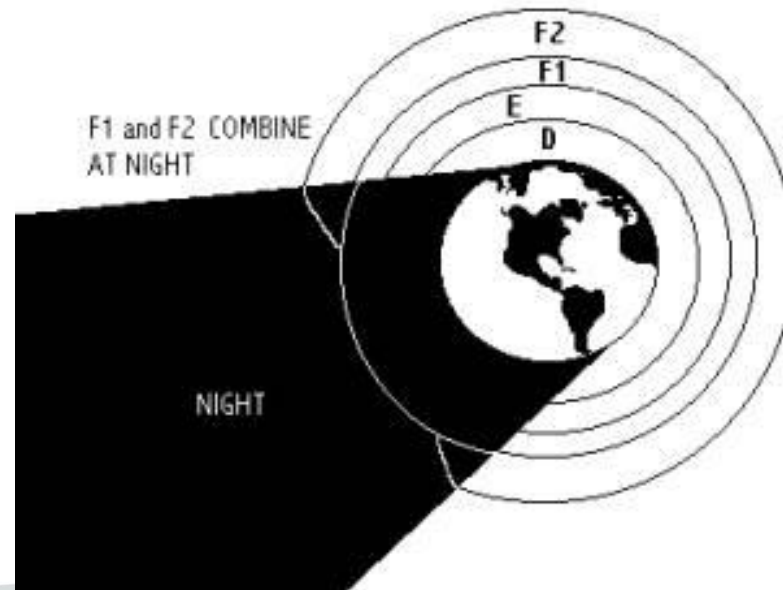
The saying “*Follow the Sun*”, in radio refers to the choice of what frequency to use. When the sun is low, the frequency in use should also be low.



Just as the sun gets higher during the day, the frequency in use should also get higher.

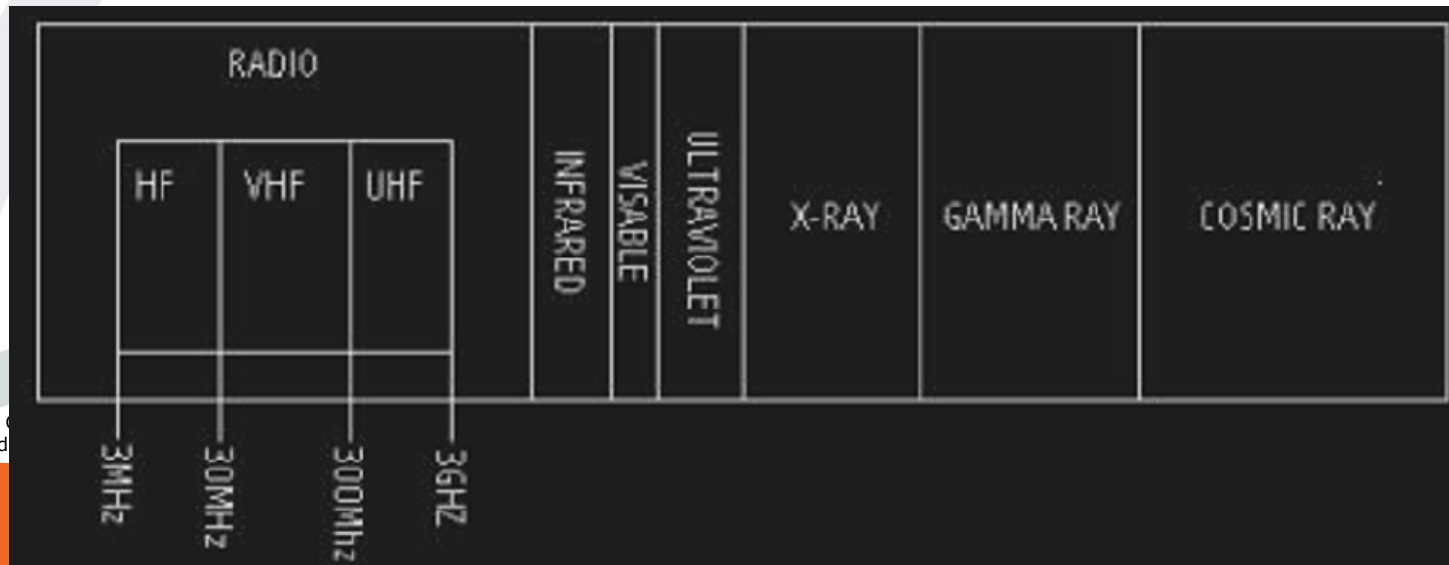
# The Ionosphere

- The Ionosphere consists of several layers of gas molecules that have been charged by high-energy particles from the Sun. The Ionosphere changes drastically during the Earth's 24-hour rotation. During the day the Sun's rays charge the ionosphere into layers. The layers are at different heights which vary by season.



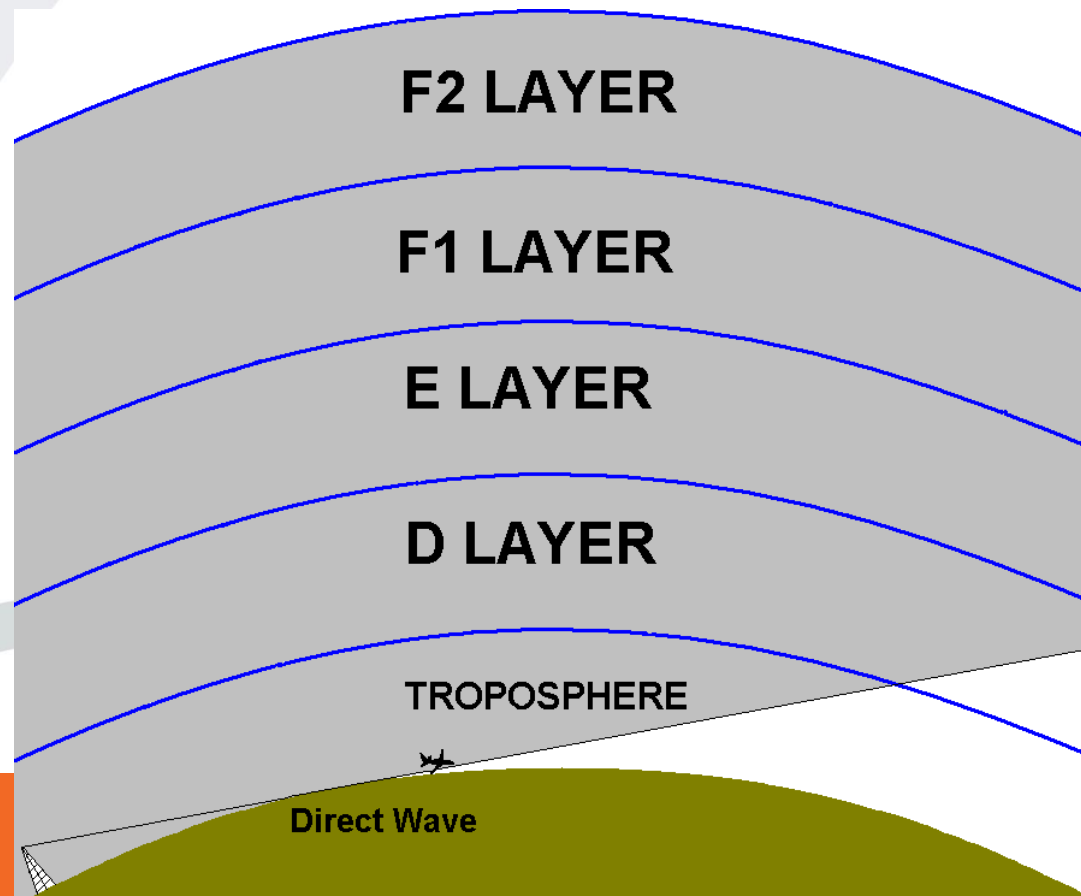
# RADIO WAVE PROPAGATION

- High Frequency (**HF**) radio waves (3 to 30 Megahertz) have the ability to travel over extremely long distances.
- HF radio waves have the property of being reflected or refracted by the Ionosphere much as a mirror reflects light and a lens bends it. HF waves can also be reflected by the Earth's surface as they are refracted by the Ionosphere. The reflecting and bending of the radio waves is what allows the signal to travel long distances beyond the Earth's horizon, or beyond the line of sight.
- This movement of radio waves is called Propagation.



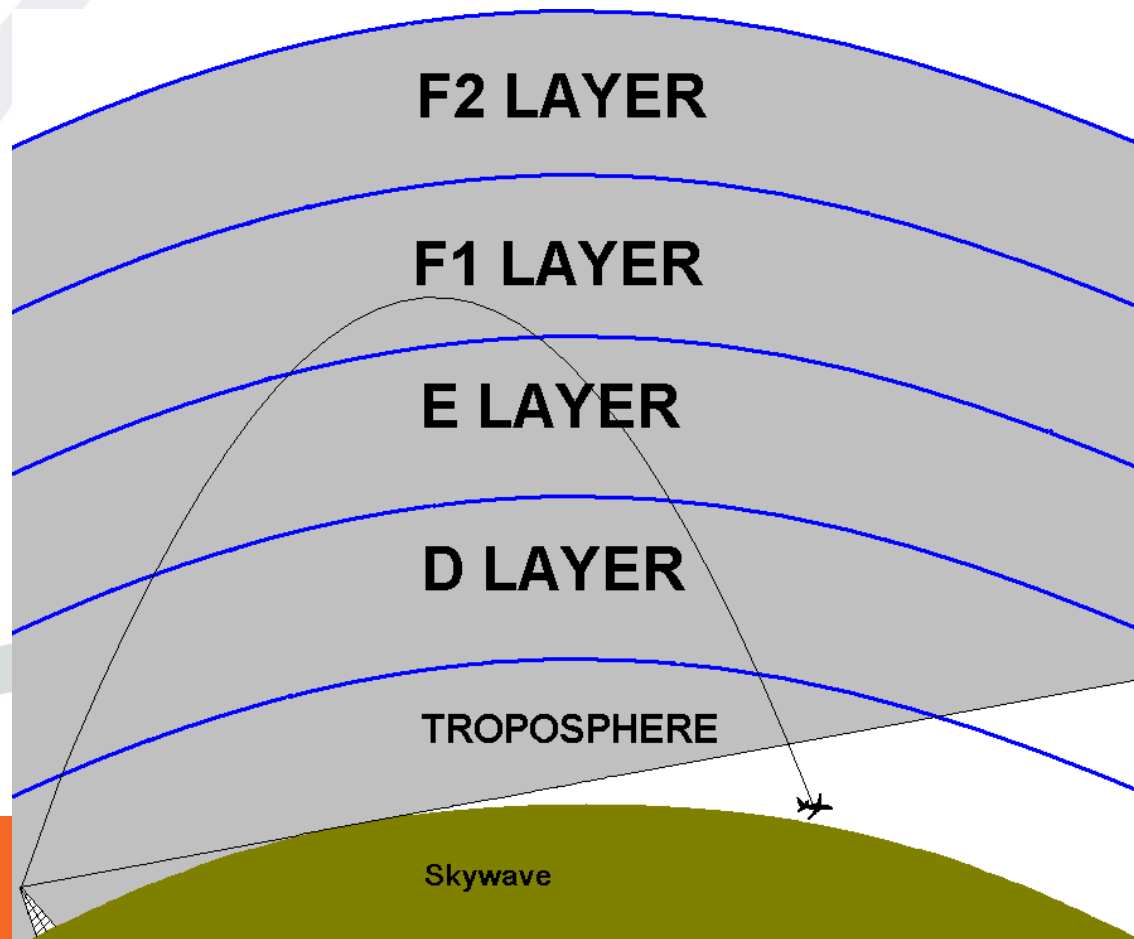
# RADIO WAVE PROPAGATION

- Ground waves require a path where both antennas have a clear line of sight to one another with no obstructions. VHF and UHF transmissions use this path. The portion of the radiated energy that is directed above the horizon constitutes *sky waves*. Sky wave communications are dependant on specific ionospheric conditions to provide the signal path between the transmitting and receiving antennas. Sky wave signals are bent by the Ionosphere.



# RADIO WAVE PROPAGATION

- The frequency choice is very important, as those above a certain value will not be refracted back to Earth but punch through into space. Conversely, lower frequencies have more static during the day because the signals are being absorbed by the lower layers of the charged Ionosphere.



# Effects of Solar Activity on HF Radio

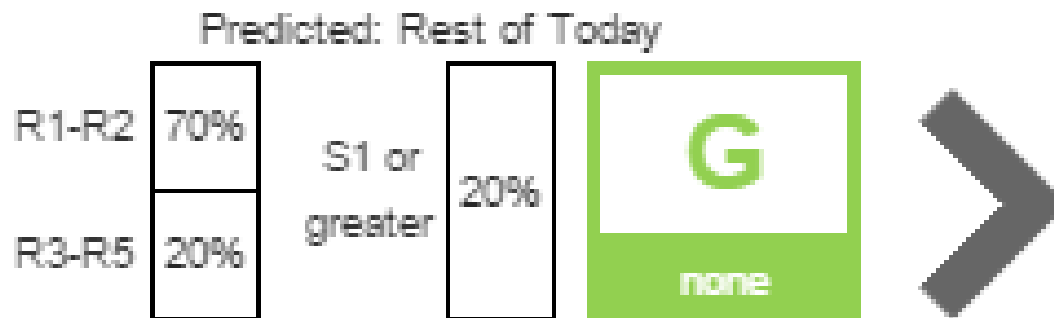
When sunspot 2297 began tracking across the surface of the Sun, Operations was briefed during the NYC morning meetings.

The eruption on March 9th at 2353Z, (X-Ray flux exceeding M5 – NOAA scale R2- Moderate) over the Pacific that marginal impact to HF Comms at the SFO Comm Center from approximately 2353Z – 0045Z.



# Effects of Solar Activity on HF Radio

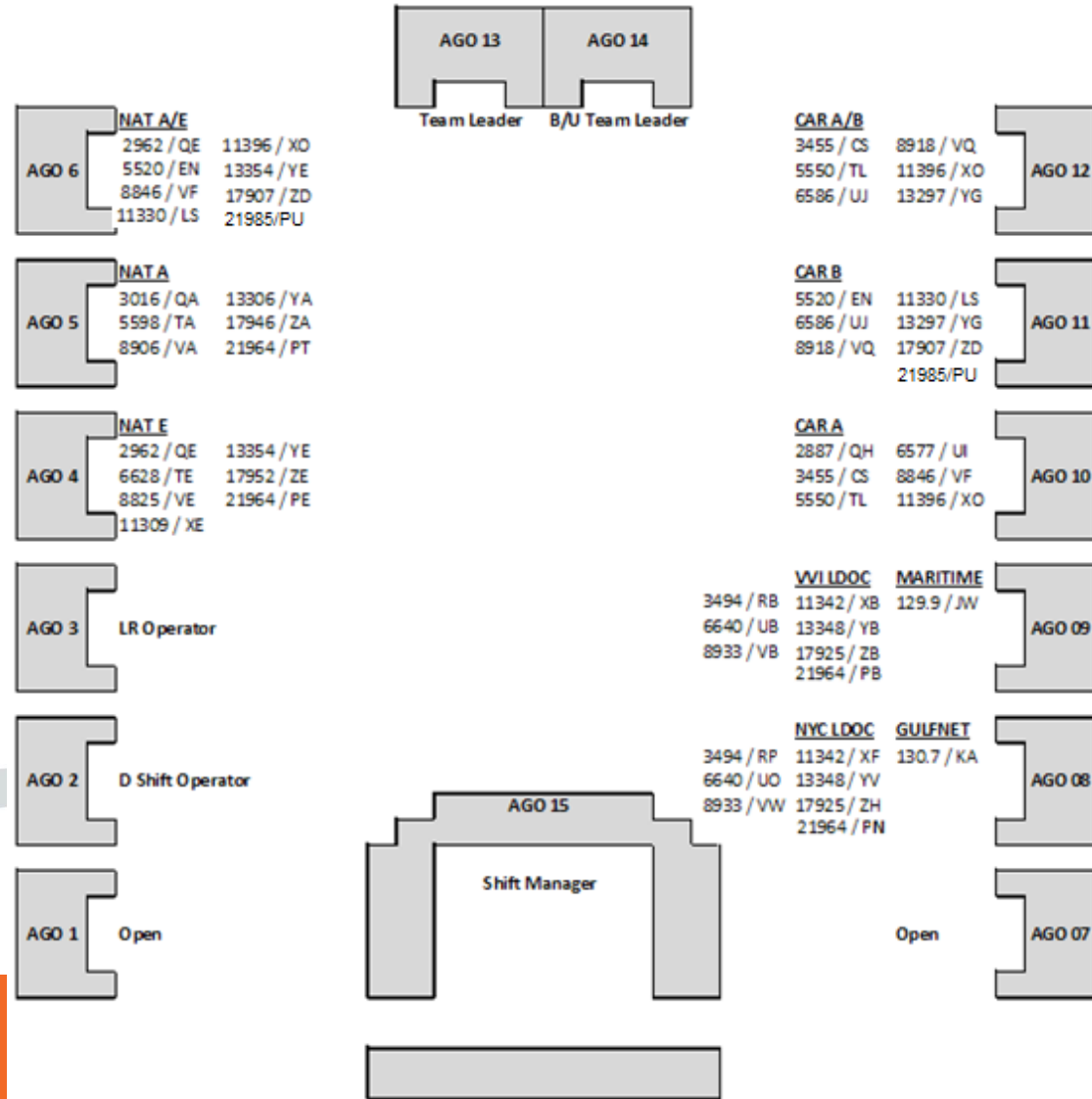
The morning of 11MAR13 NYC Radio Operators are made aware of the possibility of a solar event.



# Effects of Solar Activity on HF Radio

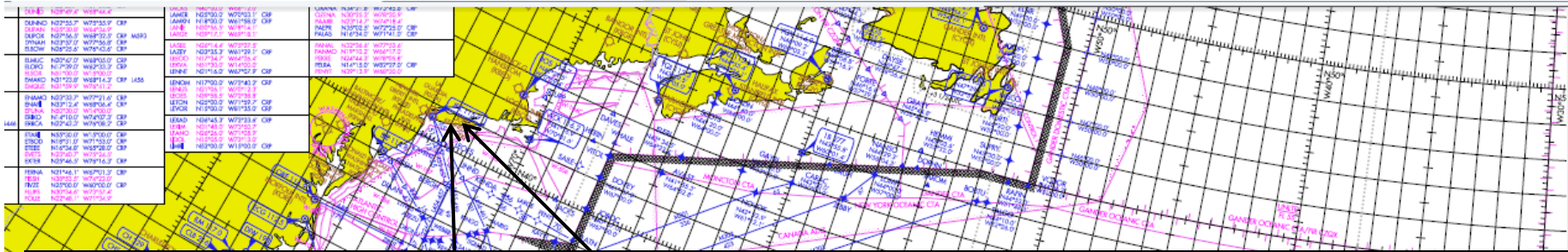
Utilizing the Space Weather Conditions forecasted on the new NOAA SWPC Aviation Community Dashboard, Radio Operators were made aware of the potential HF Radio Blackouts.

Our expertise in the utilization available frequencies enables us to effectively handle solar activity.





# Effects of 11MAR15 Event



North Atlantic E Radio Operator guards for flights at the furthest

QU NYCAPXA MIAOXII MADWOII JFKOXII ORDOXII  
.NYCXGXA 111616

POS  
FI IIII6585/OV 25N040W 1614 F350/OS CPDLC NEXT SJU OBIKE  
OS ZE YE SLOK  
DT NYC ZE B 111614 04



# Solar event 11MAR15

At 1619Z the following alert was issued:

Space Weather Message Code: ALTXMF  
Serial Number: 253  
Issue Time: 2015 Mar 11 1619 UTC

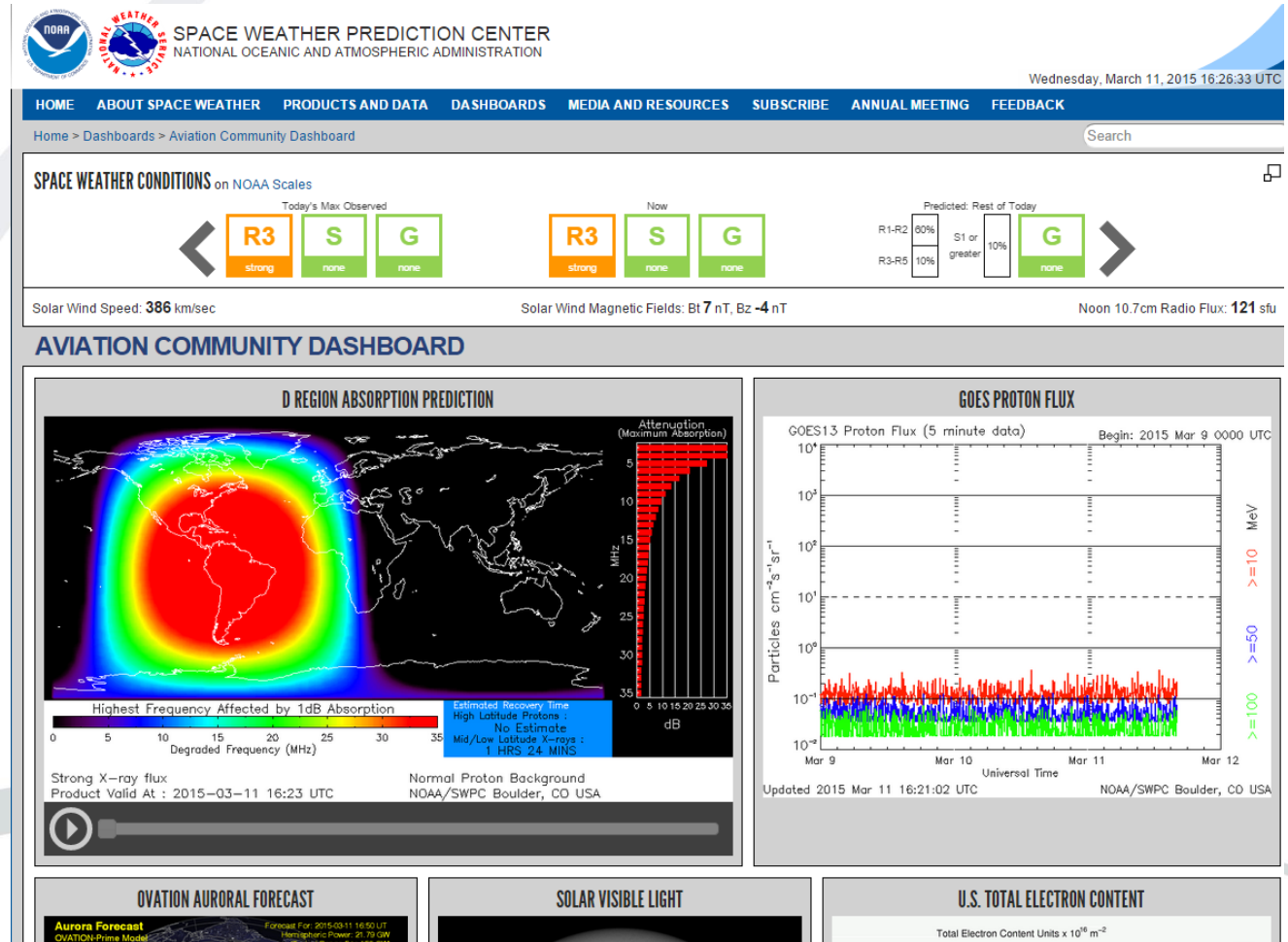
ALERT: X-Ray Flux exceeded M5  
Threshold Reached: 2015 Mar 11 1617 UTC  
NOAA Scale: R2 - Moderate

NOAA Space Weather Scale descriptions can be found at  
[www.swpc.noaa.gov/noaa-scales-explanation](http://www.swpc.noaa.gov/noaa-scales-explanation)

Potential Impacts: Area of impact centered on sub-solar point on the sunlit side of Earth. Extent of blackout of HF (high frequency) radio communication dependent upon current X-ray Flux intensity. For real-time information on affected area and expected duration please see  
<http://www.swpc.noaa.gov/products/d-region-absorption-predictions-d-rap>.

# Solar event 11MAR15

At 1622Z,  
sunspot region  
2297 delivered  
the first X-  
class solar  
flare of this  
year: it was the  
source of a  
major X2.2  
(R3-strong)  
solar flare



# Effects of 11MAR15 Event



The North Atlantic E Radio Operator is one of the first to have communications difficulty.

QU  
.NYCXGXA 111616  
AGM  
FI VVV29N/OS CPDLC FLT LC NOT READING NY  
DT NYC ZE D 111616 04

1480 nautical miles

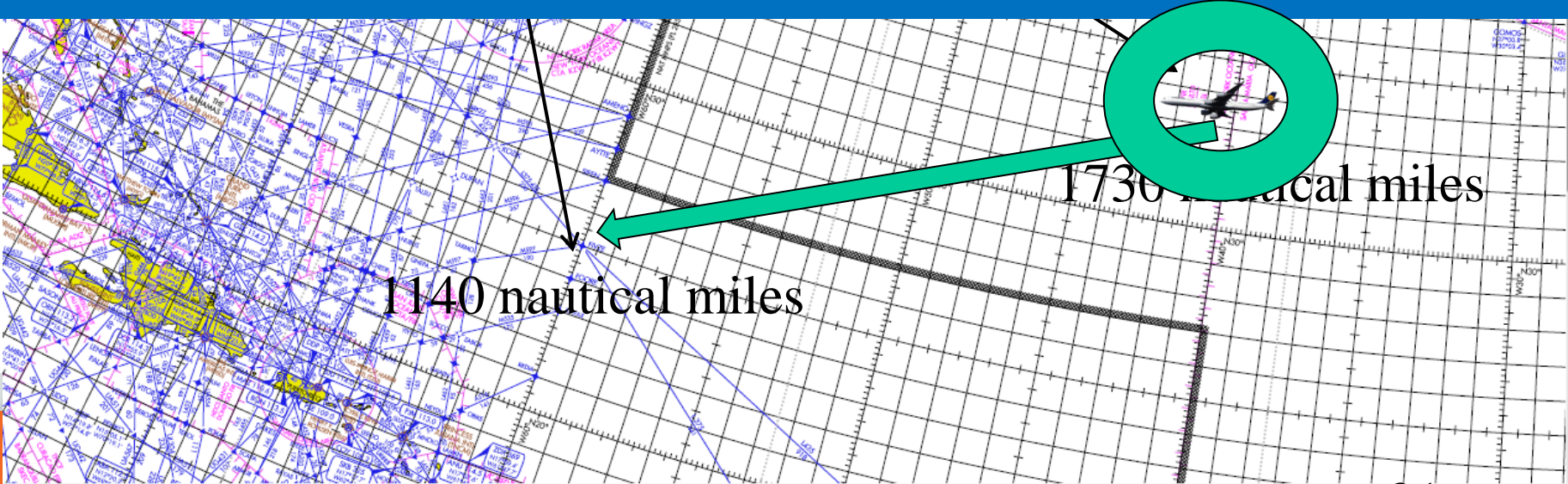
1535 nautical miles

# Effects of 11MAR15 Event

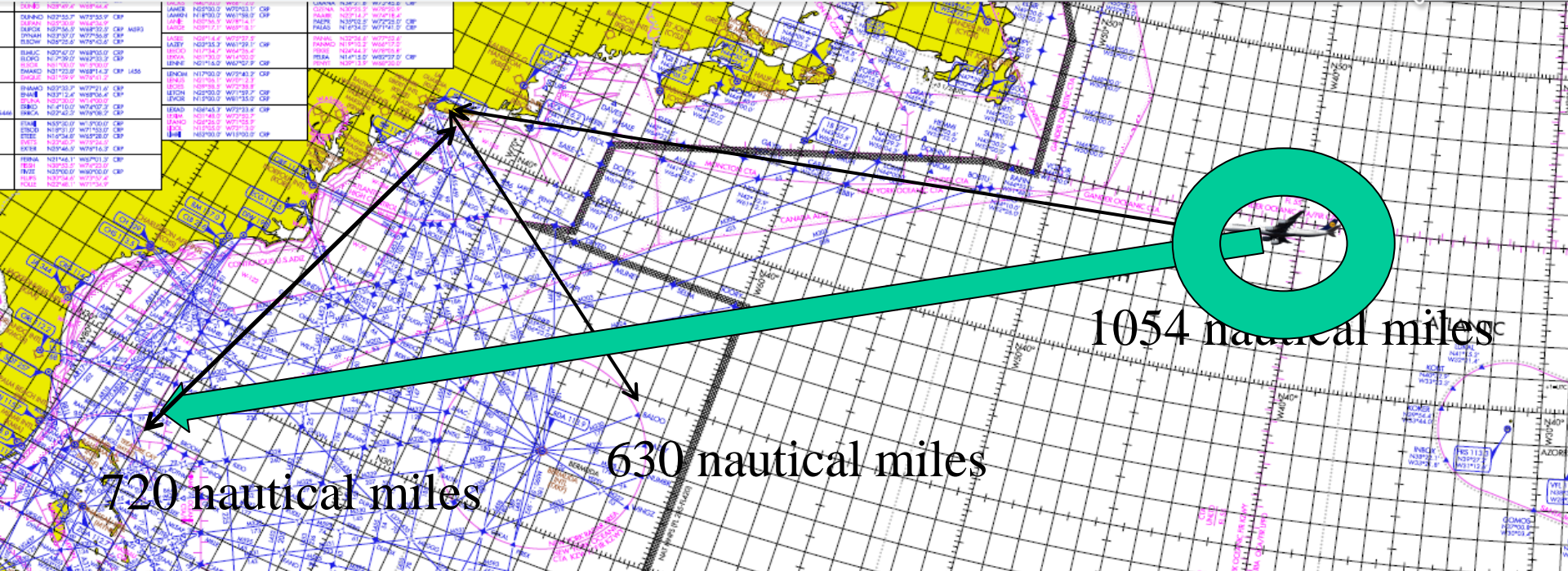


Flights became very weak on the primary HF Frequency of 17952kHz (ZE).

```
QU RUROOXA  
.NYCXGXA 111618  
AGM  
FI III6365/OS VERY WEAK NOT READING NY  
DT NYC ZE D 111618 04
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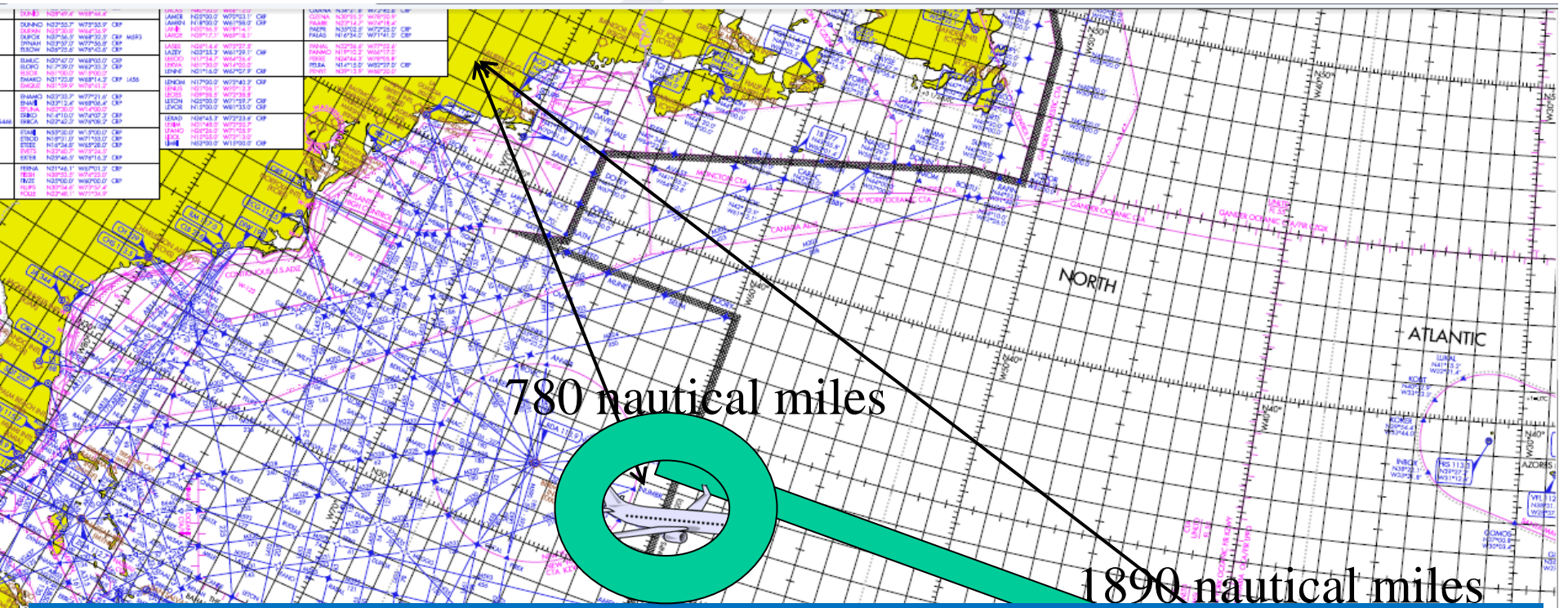
# Effects of 11MAR15 Event



QU  
 .NYCXGXA 111629  
 AGM  
 FI VVV27X/OS CPDLC EXIT BALOO PE YE  
 DT NYC PE A 111627 04



# Effects of 11MAR15 Event



QU NYCAPXA

Eastbound aircraft heading to Africa are being instructed by ZNY (New York ARTCC) Air Traffic Controllers operating Bermuda RADAR to call NYC on HF 21964kHz.

FI N111AP /OS TXKF TO GOOY/OV WINGZ 1625 F410/EO 29N050W 1939  
 NP 25N040W/SL AKDE/OS PE ZE SLOK  
 DT NYC PE A 111631 04

# Effects of 11MAR15 Event

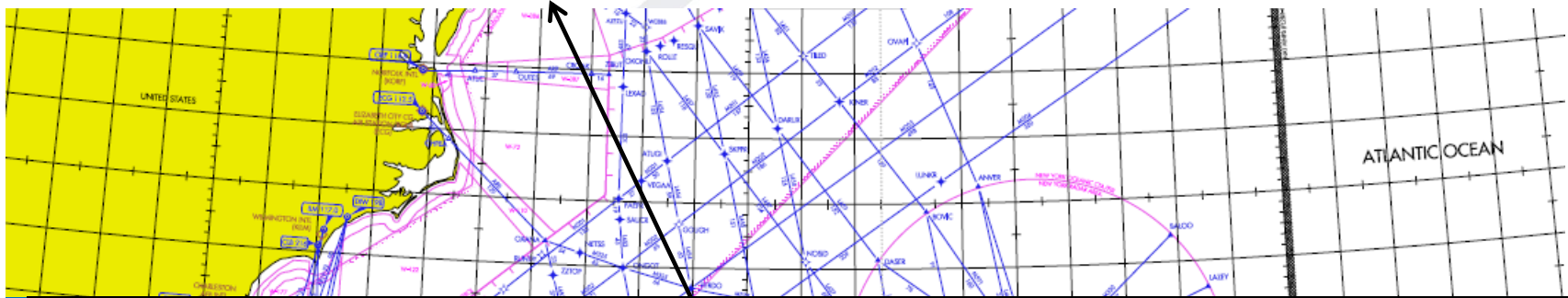
QU RUROOXA NYCAPXA OAROOXA

Aircraft in the Western Atlantic are geographically much closer to the NYC RX/TX sites and worked on lower HF frequencies. Before the event, CAR-B operations were conducted on 13297kHz.





# Effects of 11MAR15 Event



After the event, WWW3333 could not communicate with NYC on primary and secondary assigned HF frequencies and called NYC using Inmarsat SatCom Voice services.

OS UNABLE TO CONTACT ON ANY HF  
OS NYC RB S ZJU 125.0  
DT NYC SP A 111641 13



18 nautical miles

# Effects of 11MAR15 Event



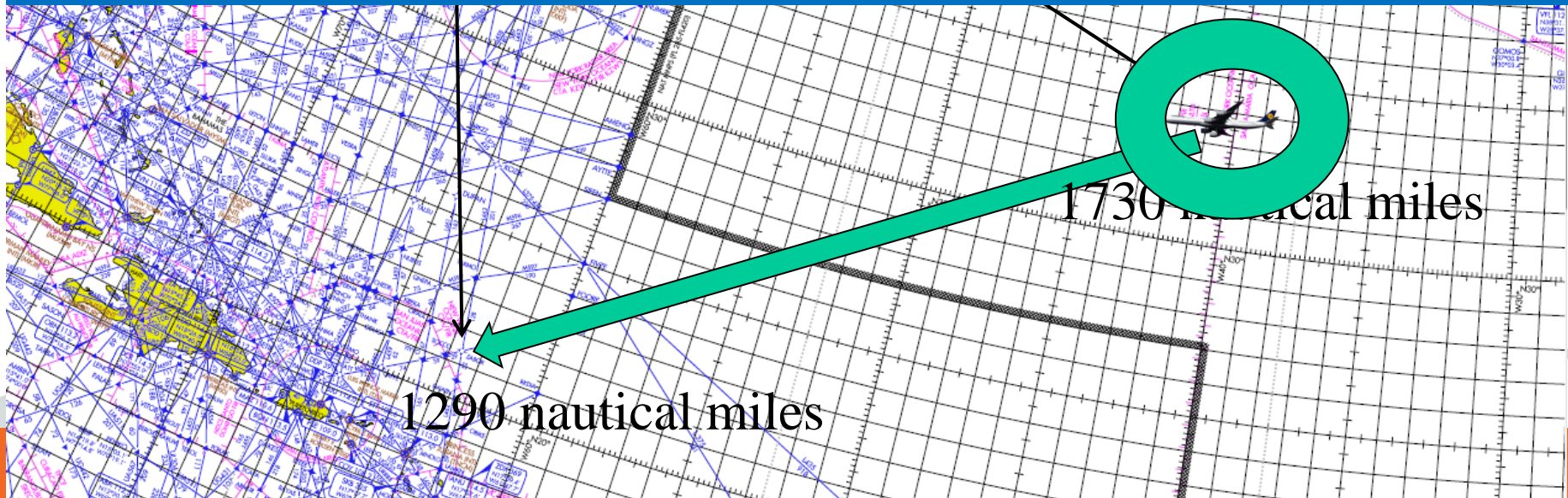
Even during Solar events, Air Traffic Control Clearances are still required to be delivered to aircraft in a timely manner to ensure flight safety.

MA 8750

DT NYC PE A 111633 04

- ZNY16 ATCC XXX22 CLIMB TO AND MAINTAIN F370, REPORT LEVEL F370 16:29:57

XXX22 RB



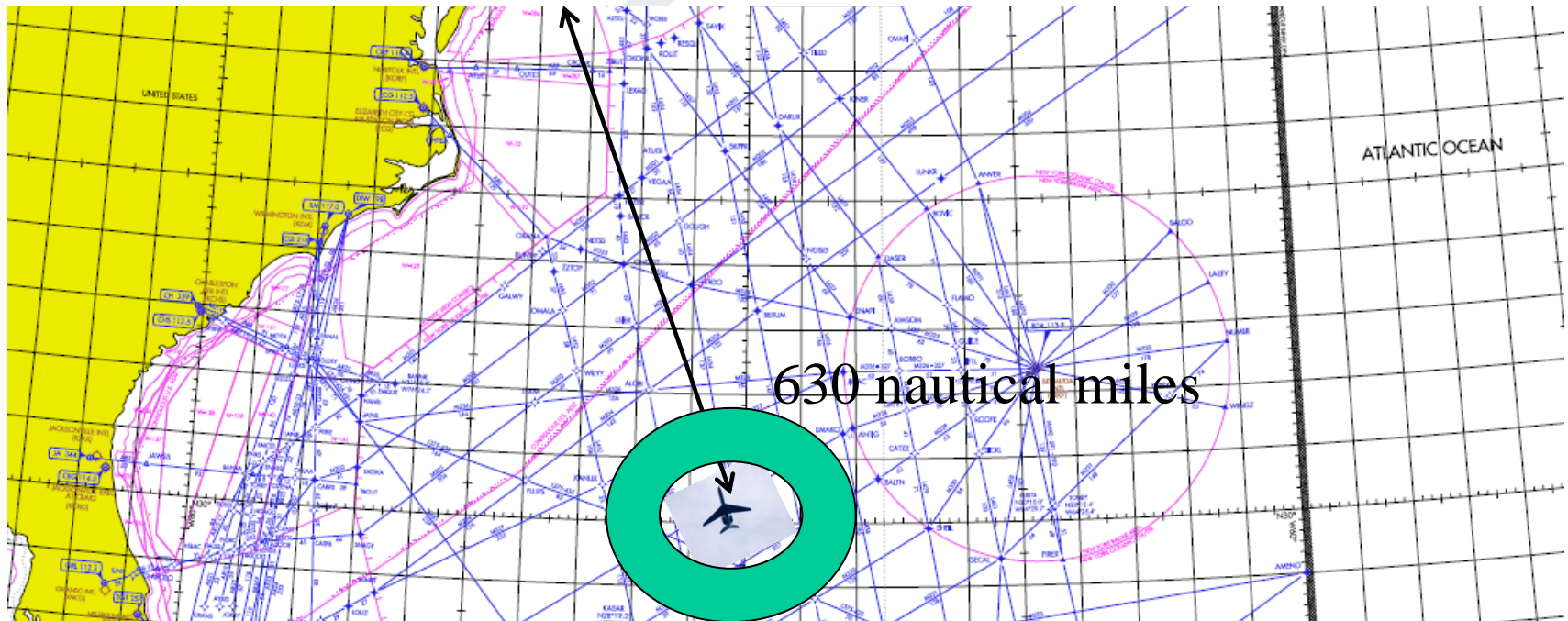
# Effects of 11MAR15 Event

```
QU OAROOXA  
.NYCXGXA 111642  
FF EIAAZZZX EIAAPCPX TTZPZQZX CZQXZOZA LPZZLPPO  
111642 KNYCXAAG  
AGM  
FI NYCHF  
DT NYC XX D 111641 14  
- NAT A: 21964 17946  
NAT E: 21964 17952  
DUE TO SOLAR ACTIVITY
```

Coordination messages sent to adjacent ARTCC that border the New York airspace.



## Effects of 11MAR15 Event



In the WATRS airspace where aircraft are geographically much closer to our TX/RX sites, we normally work flight on 6577kHz on NYC's CAR-A HF group during the winter and early spring during the time that this event occurred. Flights in the CAR-A airspace were being worked on our CAR-AB. Utilizing 13297kHz and making the report 20 mins late.



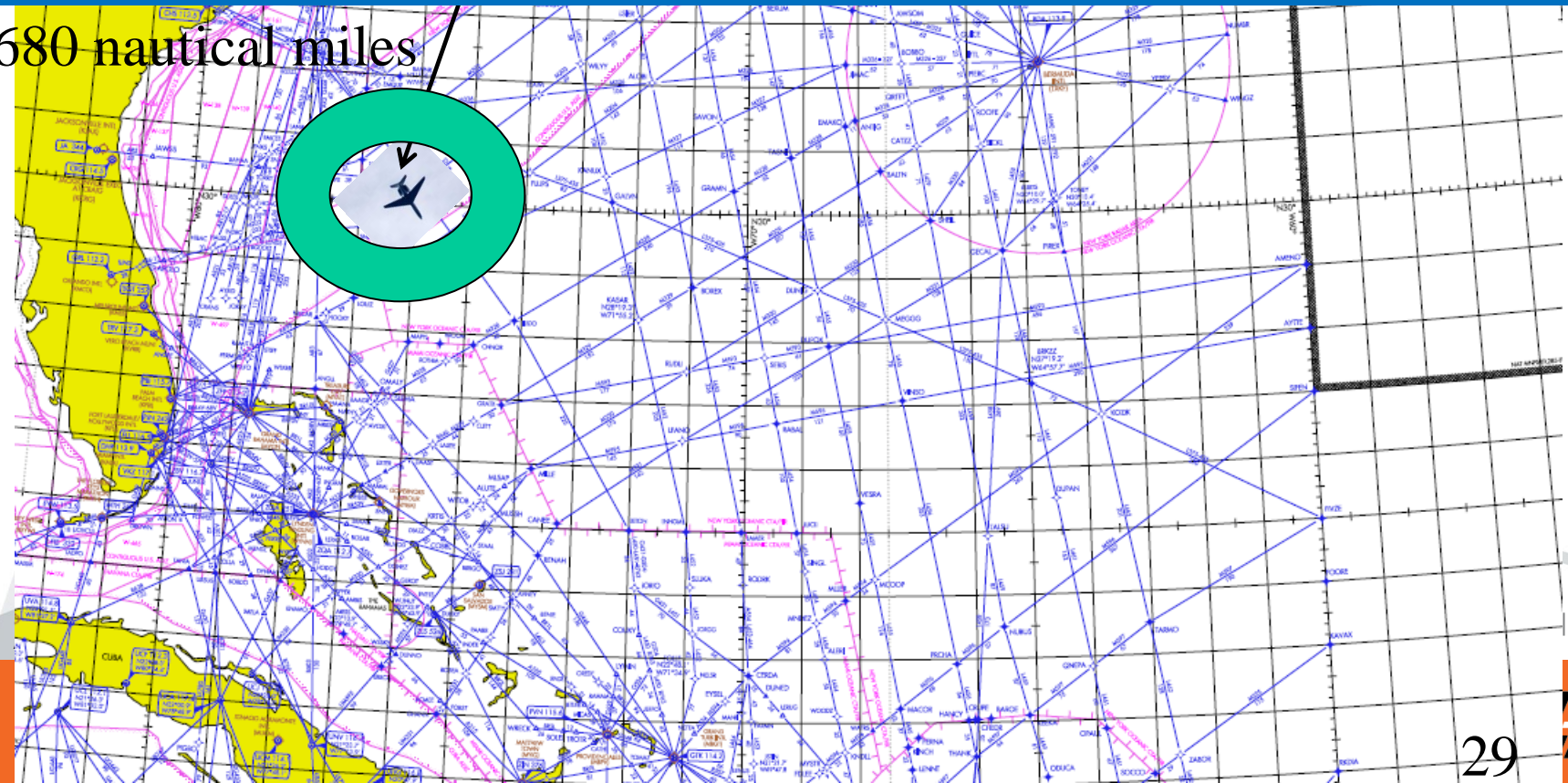
# Effects of 11MAR15 Event

OU NYCAPXA

Aircraft released from ZJX (Jacksonville ATC) that are normally worked on 8918kHz during the daylight hours are being worked on 21985kHz (PU)

DT NYC PU D 111642 11

680 nautical miles



# Effects of 11MAR15 Event

QK NYCXGXA

.CHIXCXA 111653

GG KNYCXAAG

111653 CYQXYFYX

ATTN: WATCH MANAGER

DUE TO SOLAR ACTIVITY

GANDER RADIO WILL BE USING THE FOLLOWING FREQUENCIES UFN:

13291 11279

RGDS CYQX IFSS SHIFT SPVR/WA

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# Effects of 11MAR15 Event

Coordination of AIR-GROUND / GROUND-AIR communications support is accomplished by interfacility communications with adjacent service providers via AFTN / AVINET (IATA) messages and telephone coordination. This ensures constant awareness between the service providers of the current HF radio conditions that may be adversely affected by Solar events.

## Closing

Rockwell Collins IMS / ARINC Radio Operators adhere to ICAO (international) and FAA (federal) procedures in the realm of Voice and Data communications. Their experience and expertise in the application of these procedures is part of the checks and balances that ensures safety of all flights in the Oceanic Airspace.