



# International Data Distribution

SAR Controllers Training 2016

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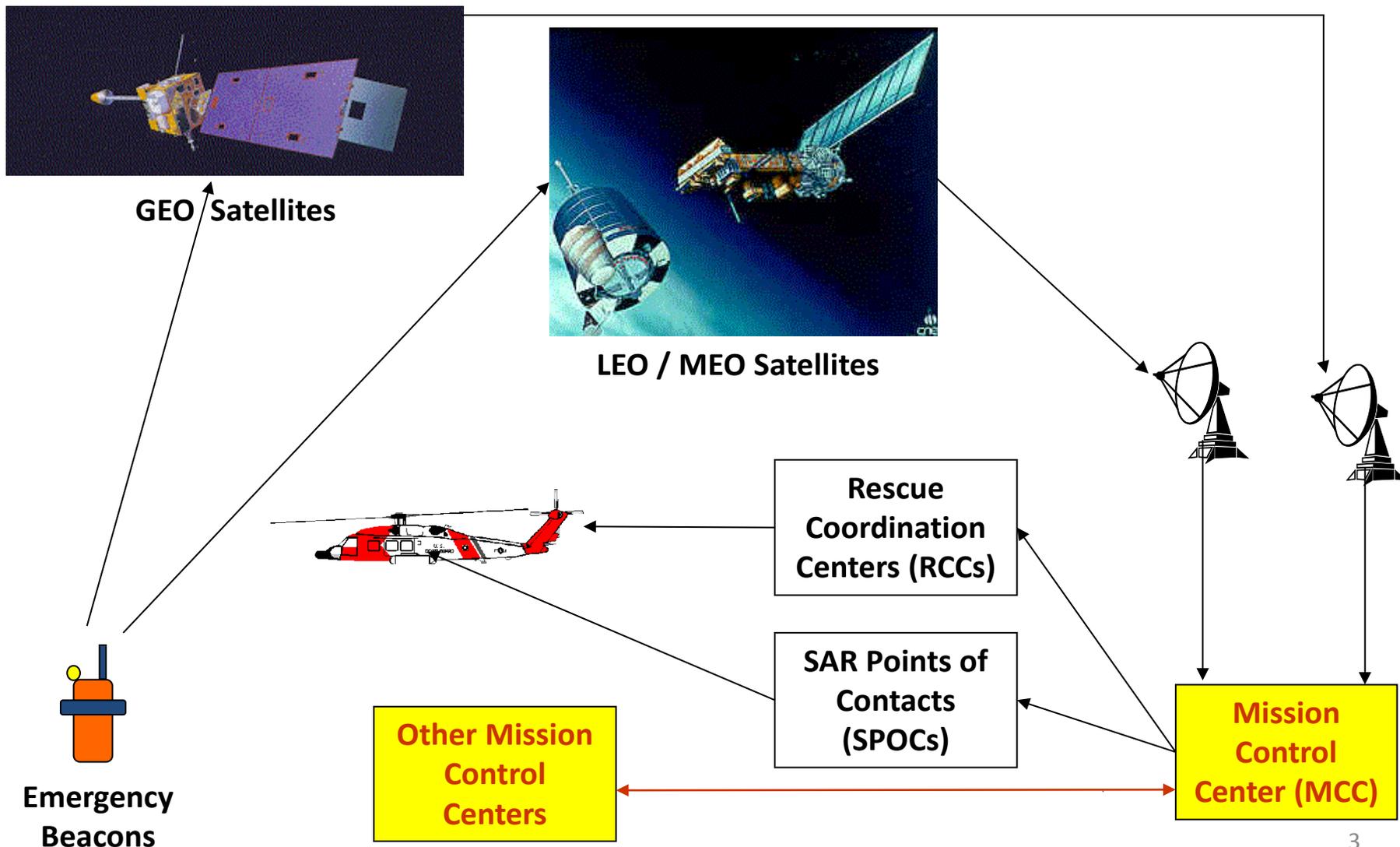


# MCC to MCC Data Distribution

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- Cospas-SARSAT is designed to:
  - Save lives through
    - Early detection of distress – sometimes only detection
    - Minimizing search time
    - Quick recovery
  - Consider
    - Number of extended searches - past vs. present
    - Cost of an extended search

# MCC to MCC Data Distribution





# MCC to MCC Data Distribution

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- Data Distribution Procedures are described in the Cospas-SARSAT Data Distribution Plan (DDP), A.001
- Located alerts are usually distributed based on location
- Unlocated alerts are distributed based on beacon country code
- Notification of Country of Registry (NOCR) messages are distributed based on country code (by MCC with alert located in its SRR, when the alert's not in SRR of country of registration)
- Ship security (SSAS) alerts are distributed based on country code
- Each beacon event (detect time / satellite / beacon) is only sent once



# MCC to MCC Data Distribution

## MEOSAR Data

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- The current operational system only includes LEOSAR/GEOSAR data (L/G system)
- MEOSAR data will be added to the operational system, forming the LEOSAR/GEOSAR/MEOSAR (LGM system)
  - Initial operations requires commissioning of MEOLUTs and two associated MCCs (USMCC and FMCC planned)
  - Initial operations expected to start in August 2016
- In this presentation, references to MEOSAR data and the LGM system are provided in *italics*



# MCC to MCC Data Distribution

## L/G vs. LGM System

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- A single Difference of Arrival (*DOA*) position computed by *MEOLUT* vs. Doppler A/B positions computed by *LEOLUT*
  - *DOA* position computed using differences in Time of Arrival (*TOA*) and/or Frequency of Arrival (*FOA*) data from multiple *MEOSAR* satellites
- Determination of real beacon position
  - Requires data from independent sources (for *L/G* and *LGM* systems)
  - deemed “Position Confirmation” (*LGM*) vs. “Ambiguity Resolution” (*L/G*)
    - no *A/B* position ambiguity with a single *DOA* position
  - Independence requires a difference in detect time or satellite(s)



# MCC to MCC Data Distribution

## L/G vs. LGM System

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- Ambiguity resolution (L/G) requires independent Doppler positions or a Doppler and encoded position that match within 50 km
- *Position confirmation (LGM)* requires independent Doppler positions, independent DOA positions, a Doppler and DOA position, a Doppler and encoded position, or a DOA and encoded position that match within 20 km
- Ambiguity resolution / position confirmation alert sent to all previous alert recipients for beacon activation
- No messages are sent to MCCs after ambiguity resolution (L/G)
- By default, messages are sent after *position confirmation (LGM)* to the MCC associated with the real position



# MCC to MCC Data Distribution MEOSAR (LGM)

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- New alert with DOA location distributed when:
  - DOA location first received
  - Subsequent DOA location has improved Expected Horizontal Error (EE):
    - Less than 150 nm (277.8 km) and
    - At least 2 nm (3.7 km) less than lowest previously sent DOA expected error and
    - At least 50% less than lowest previously sent DOA expected error
  - Position confirmation is achieved; for 2 DOA positions this requires:
    - Each DOA alert to include data from one satellite not included on the other alert or
    - At least 30 minute time separation for the two DOA alerts.
    - Position can also be confirmed by DOA, with Doppler or encoded position
  - Before position confirmation, 5 minutes expires since previous DOA alert
  - Before position confirmation, position conflict occurs (20 km threshold)
  - After position confirmation, position update every 15 minutes (if position update available)
  - After position confirmation, position conflict occurs (as long as no position conflict alert was distributed in last 10 minutes)



# MCC to MCC Data Distribution Nodal Distribution Network

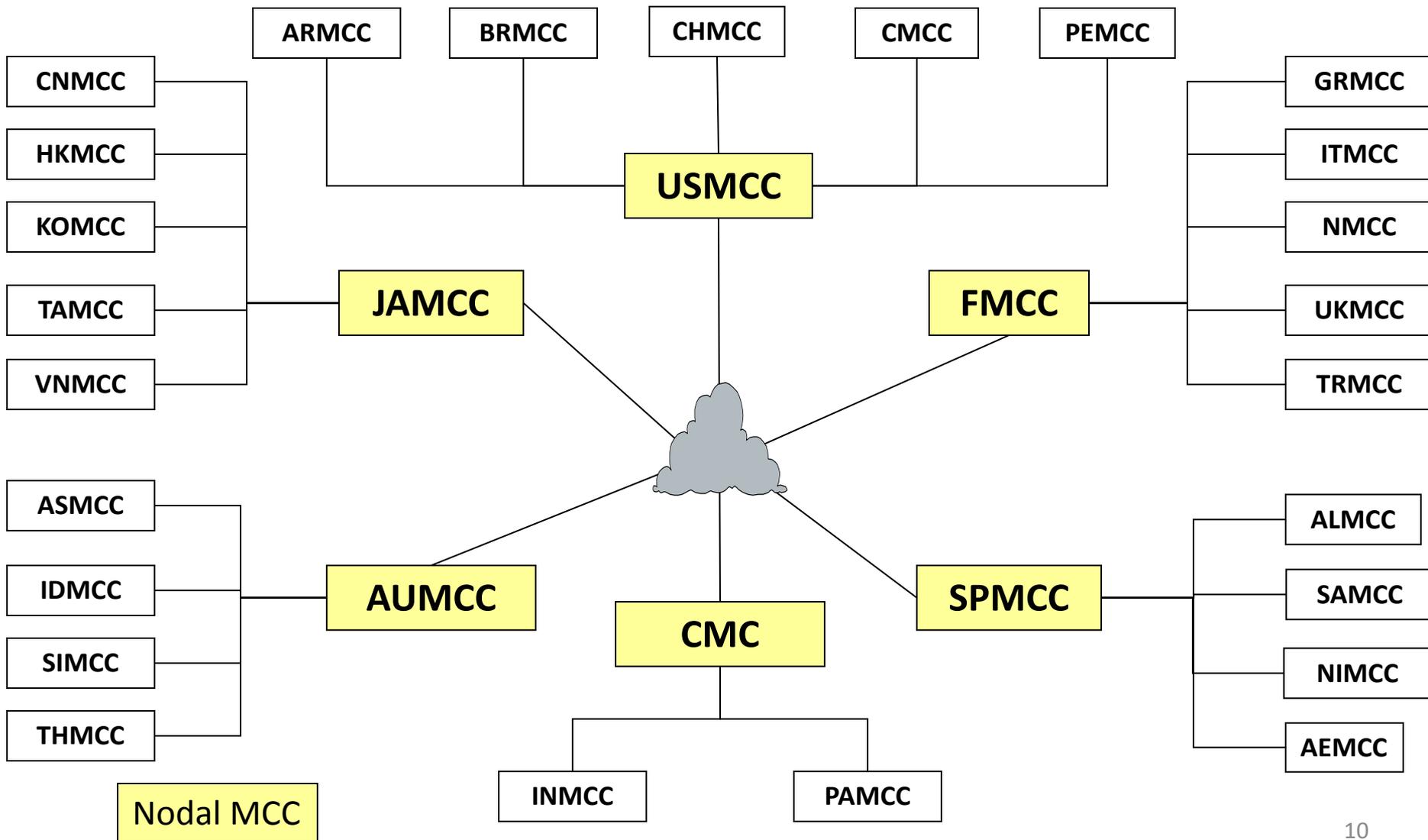
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- Messages are sent between MCCs via nodal system
- Each Data Distribution Region (DDR) has a nodal (hub) MCC
  - the nodal MCC distributes messages to all MCCs in its DDR and to all other nodal MCCs
  - non-nodal MCCs only distribute messages to the nodal MCC in its DDR\*
  - There are 6 nodal MCCs (the USMCC is nodal for the Western DDR)
- Advantages of the nodal system:
  - MCCs are not required to establish and maintain communication links with all MCCs (31 MCCs in C/S system)
  - Enables nodal MCCs to perform monitoring for all MCCs in its DDR
  - MCC backup is simpler to implement (e.g., when the CMCC is down, only the USMCC needs to change its data distribution)

\* With one exception: all MCCs in Central DDR exchange messages with each other directly



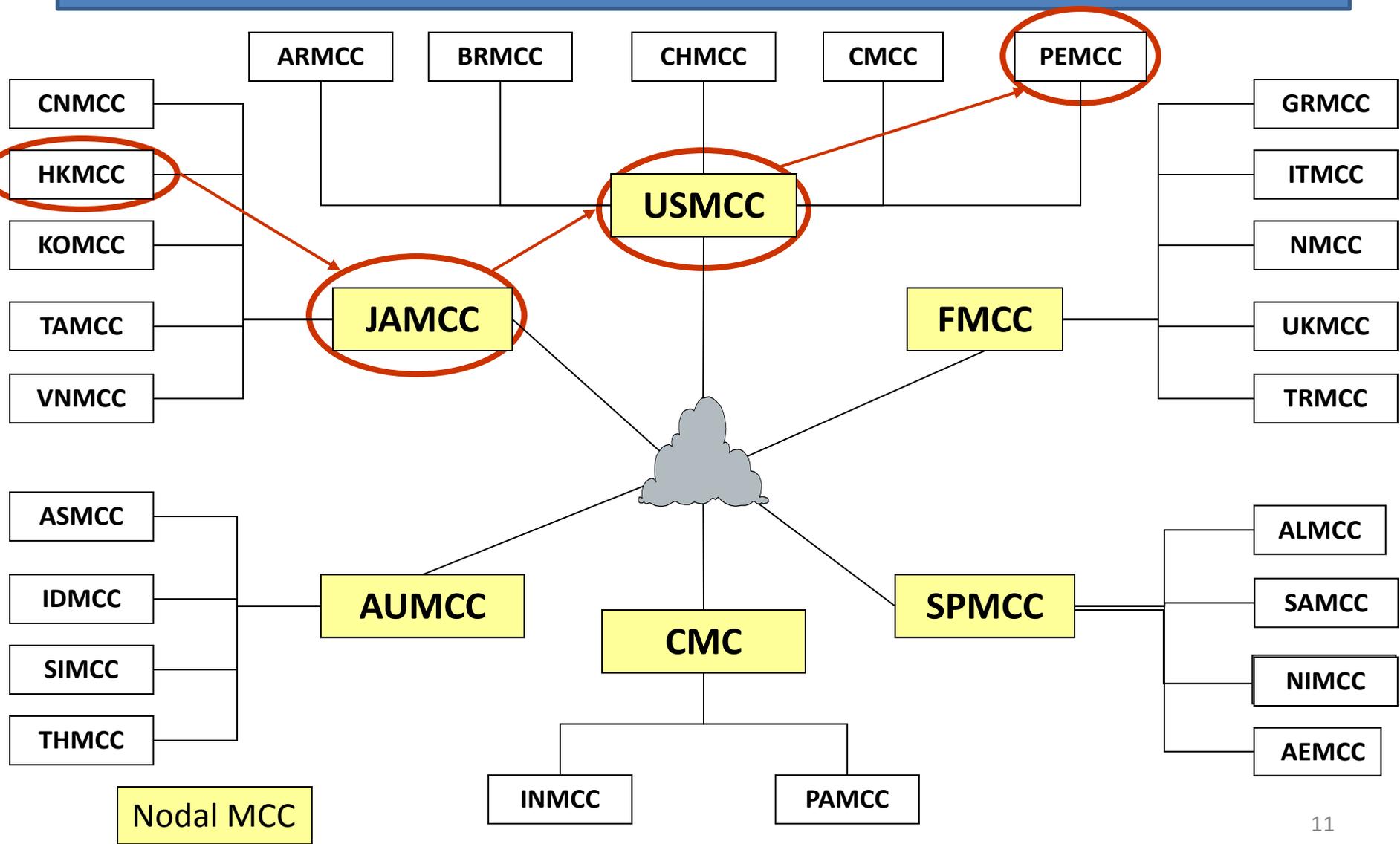
# MCC to MCC Data Distribution Nodal Distribution Network





# MCC to MCC Data Distribution

Unlocated Alert detected by HKMCC with Peru country code





# MCC to MCC Data Distribution

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## Unlocated Alert Example

Unlocated Alert detected by HKMCC with Peru country code

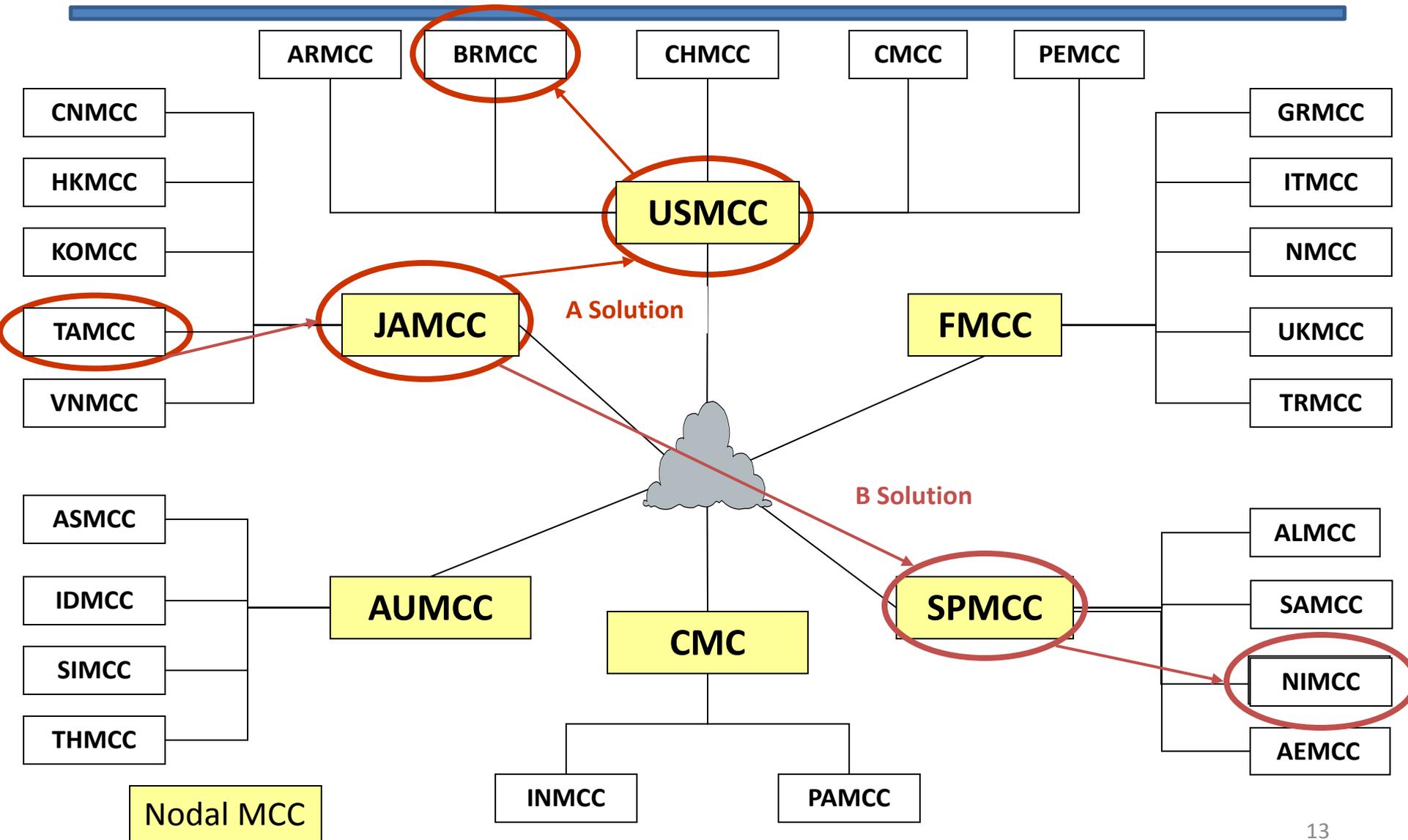
- HKMCC sends to JAMCC\*
- JAMCC sends to USMCC\*
- USMCC sends to PEMCC\*
- PEMCC sends to RCC or SPOC based on national procedures\*

\* Each MCC only sends the alert (beacon event) once to the designated destination(s)



# MCC to MCC Data Distribution

Doppler Alert detected by TAMCC with location in BRMCC and NIMCC Service Areas





# MCC to MCC Data Distribution

## First Doppler Located Alert Example

Alert detected by TAMCC with location in BRMCC and NIMCC service areas

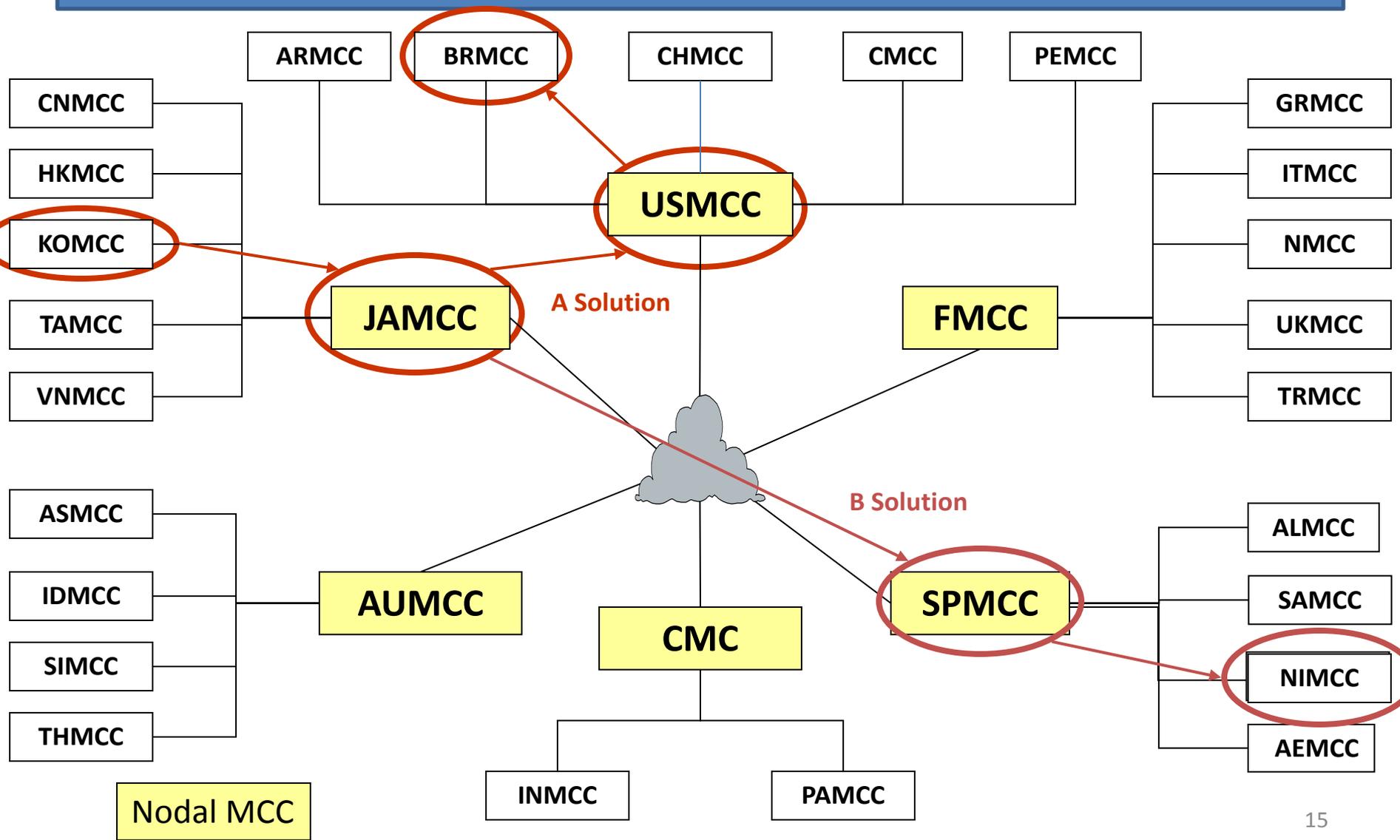
- TAMCC sends to JAMCC\*
- JAMCC sends to USMCC and SPMCC\*
- USMCC sends to BRMCC\*
- SPMCC sends to NIMCC\*
- BRMCC and NIMCC send to respective RCC or SPOC, based on national procedures\*
- Procedure above also followed for encoded *or DOA (MEOSAR)* location

\* Each MCC only sends the alert (beacon event) once to the designated destination(s)



# MCC to MCC Data Distribution

Doppler Alert detected by KOMCC with location in BRMCC and PEMCC service areas - Ambiguity is resolved (*position is confirmed*) to BRMCC





# MCC to MCC Data Distribution

## Ambiguity Resolution (*Position Confirmation*) Example

Alert detected by KOMCC with location in BRMCC and PEMCC service areas

Ambiguity is resolved to BRMCC (same Beacon ID as previous example)

- KOMCC sends to JAMCC\*
- JAMCC sends to USMCC and SPMCC\*
- USMCC sends to BRMCC\*
- SPMCC sends to NIMCC\* (so that NIMCC knows the alert is not in its SRR)
- BRMCC & NIMCC send to respective RCC or SPOC based on national procedures\*

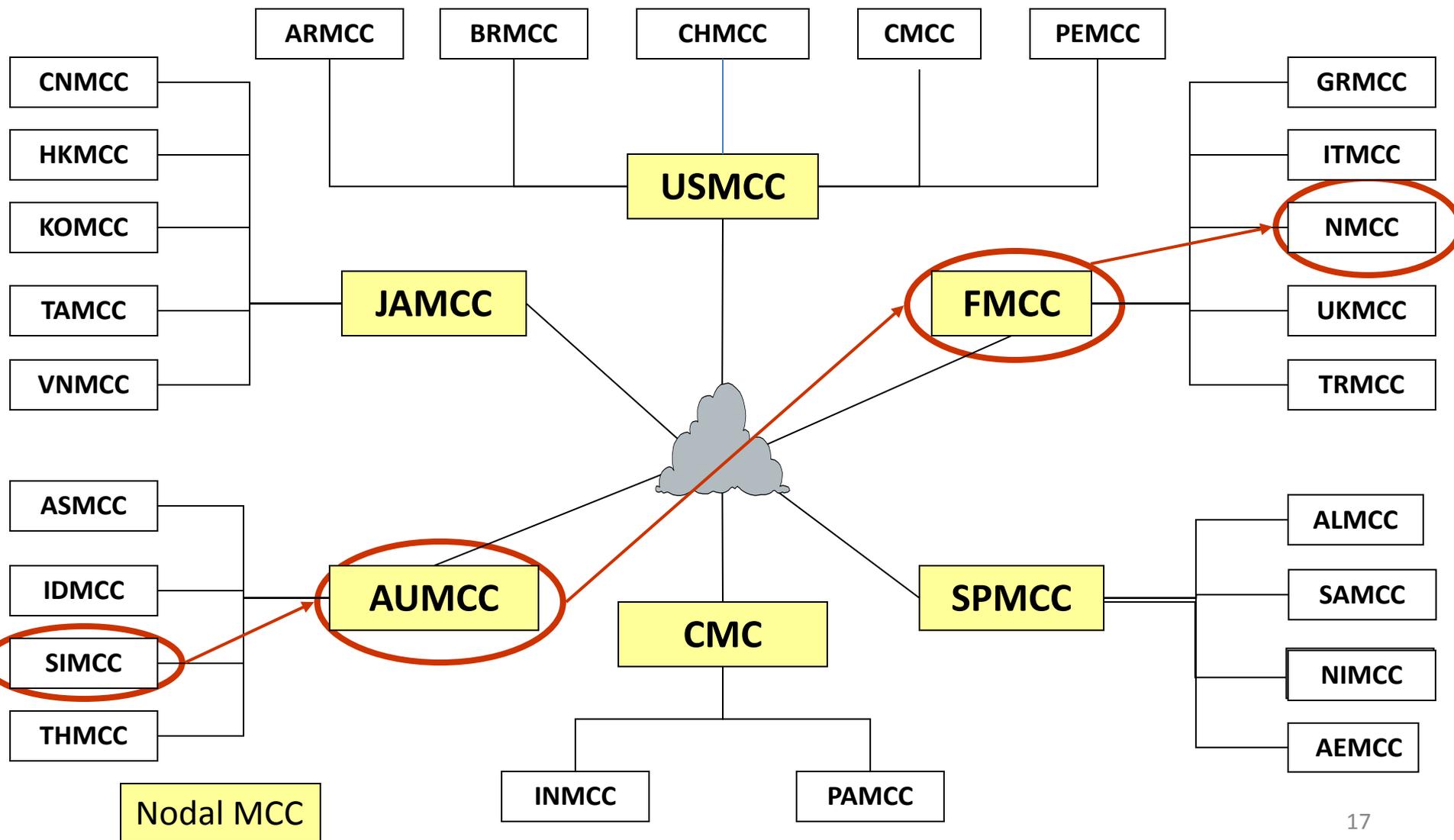
\* Each MCC only sends the alert (beacon event) once to the designated destination(s)

- **Notes:**
  - Procedure above is also followed for encoded *or* DOA (*MEOSAR*) location.
  - No message is sent to PEMCC (new position in PEMCC SRR known to be incorrect)
  - No other alerts are sent to BRMCC or NIMCC (L/G)
  - Further alerts sent to BRMCC (*LGM*), unless BRMCC opts out of continued transmission
  - To resolve ambiguity (*confirm position*), 1 Doppler *or* DOA (*LGM*) position is required

# MCC to MCC Data Distribution



NOCR Distribution - Beacon with Sweden country code is detected by SIMCC with one location of Doppler solution in SIMCC service area  
[Alert for beacon Event could have been received from another MCC]





# MCC to MCC Data Distribution

## Notification of Country of (Beacon) Registration (NOCR) Example

Beacon with Sweden country code is detected by SIMCC with one side of Doppler location in SIMCC service area [Alert for Event could have been received from another MCC]

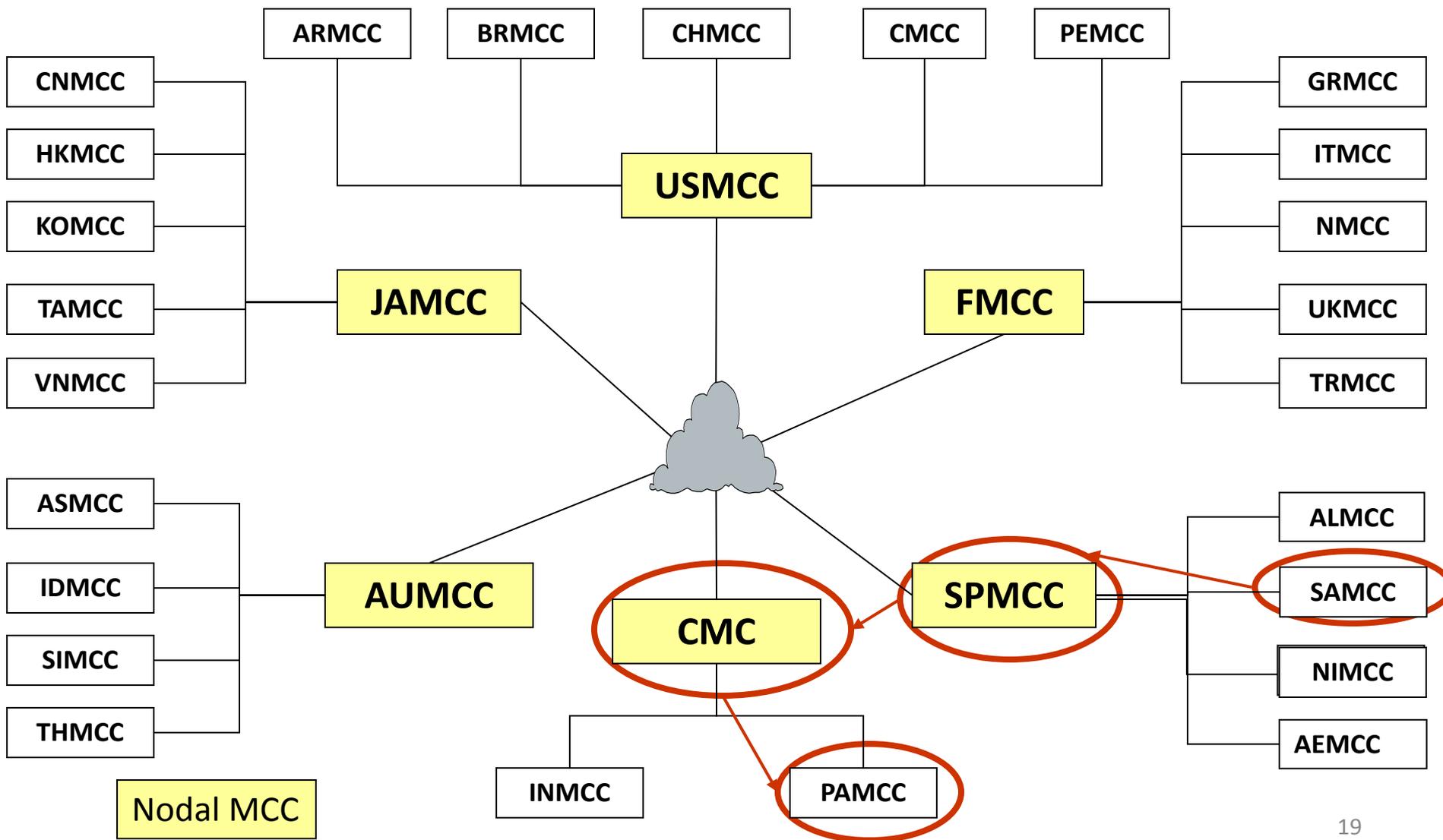
- Location is required for NOCR - encoded, Doppler or *DOA (MEOSAR)*
- SIMCC sends NOCR to AUMCC\*
- AUMCC sends NOCR to FMCC\*
- FMCC sends NOCR to NMCC\*
- NMCC sends NOCR to Sweden SPOC\*

\* Each MCC will only send one NOCR per beacon activation



# MCC to MCC Data Distribution

SAMCC detects a Ship Security beacon with a Pakistan country code, with or without location





# MCC to MCC Data Distribution

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## SSAS Example

SAMCC detects a Ship Security beacon with a Pakistan country code, with or without location

- SAMCC sends the alert to SPMCC\*
- SPMCC sends the alert to CMC\*
- CMC sends the alert to PAMCC\*
- PAMCC sends the alert to “Competent Authority” based on national procedures\*
- Distribution of SSAS alerts is independent of the beacon’s location

\* Each MCC only sends the alert (beacon event) once to the designated destination(s)



# Glossary (1 of 2)

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- Ambiguity Resolution – Real solution determination (L/G)
- Beacon Event – Unique beacon ID/Satellite/TCA (LEOSAR),  
Unique beacon Id / Satellites / Detect Time (*MEOSAR*)
- Encoded location – Location encoded in beacon ID (30 hex) – usually from internal GPS for EPIRBs and PLBs, but may be:
  - from ship navigation system for EPIRBs or
  - from aircraft navigation system for ELTs
- SRR – Search and Rescue Region
- Service Area - SRRs of an MCC and the SPOCs it supports
- DDR – Data Distribution Region, made up of service areas of MCCs assigned to a nodal MCC



## Glossary (2 of 2)

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- NOCR – Notification of Country of (beacon) Registration
- DOA (Difference of Arrival) position - computed using differences in Time of Arrival (TOA) and/or Frequency of Arrival (FOA) data from multiple MEOSAR satellites
- Position Confirmation – Real solution determination (*LGM*)
- Position conflict – distance separation of at least 50 km (L/G) or 20 km (LGM) of a new Doppler, *DOA* or encoded position vs. a reference position, where the reference position is:
  - An encoded, Doppler or *DOA* position, prior to ambiguity resolution (L/G) or *position confirmation (LGM)*
  - The resolved (or *confirmed*) position, after ambiguity resolution or *position confirmation (LGM)*
- SSAS – Ship Security Alert System
- TCA – Time of closest approach of LEOSAR satellite to a beacon



# Conclusion

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Questions?