

Challenges of Sea Search and Recovery Operations

– Sharing of Experience from a Recent Joint Operation

Presented by:

**Tatang Kurniadi – Chairman, Indonesia National
Transportation Safety Committee**

**Ng Junsheng – Accident Investigator, Air Accident
Investigation Bureau of Singapore**

**ICAO Regional Accident Investigation Workshop
Asia and Pacific Regions**

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What happened?

- 28 Dec 14, A320 operating QZ8501
- 162 persons on board
- Lost radar contact after about 41 mins
- SAR launched by Indonesia authority, BARSARNAS
- NTSC coordinated effort to locate and recover flight recorders

Scope

- **Timeline of events**
- **Locating the Flight Recorders**
- **Recovering the Flight Recorders**
- **Challenges Faced**
- **Management of Sea Search**
- **International Cooperation**
- **Conclusion**

Timeline of Events

Timeline of Events

1 Jan 15

- Search team repositioned in Pangkalan Bun (PKN)
- 2 DGST vessels allocated to search team

2 Jan 15

- 1st deployment attempt to Search Location 1

28 Dec 14

- QZ8501 missing over Java Sea
- Singapore made offer of assistance

3 Jan 15

- BASARNAS identified area of high probability
- Search team decided to detour to this area
- 2nd deployment attempt

29 Dec 14

- NTSC accepted Singapore's assistance

6 Jan 15

- BASARNAS confirmed parts found not aircraft parts
- Search team departed for Search Location 1
- CAAC investigators arrived in PKN, boarded coast guard vessel

31 Dec 14

- Singapore team and UK AAIB investigator arrived in Tanjung Pandan
- Met up with NTSC & BEA personnel
- Preliminary search plan discussion

4 Jan 15

- Arrived in Search Location 2
- Turned back due to sea state

Timeline of Events

7 Jan 15

- En-route to Location 1, tail section located by SAR effort
- Search team arrived in Location 1
- Hydrophone listening & sonar scan

10 Jan 15

- Additional divers arrived
- Ping signal detection by USBL system
- Survey of recovered tail section

8 Jan 15

2nd round of hydrophone listening

9 Jan 15

- Dive operation commenced
- ROV deployment
- AUV deployment

13 Jan 15

- CVR recovered
- Special purpose navigational buoy laid

12 Jan 15

FDR recovered

11 Jan 15

- Even more divers arrived
- Plans made to lift aircraft debris

Locating the Flight Recorders

Locating the Flight Recorder

Underwater Search Team

| | |
|-----------------|--|
| NTSC, Indonesia | 1 adviser to Chairman 2 investigators |
| CAAC, China | 3 investigators |
| BEA, France | 1 investigator |
| AAIB, UK | 1 investigator |
| AAIB, Singapore | 4 investigators |
| MPA, Singapore | 6 hydrographic specialists |

Equipment

| | |
|-------------------------------|--------|
| Directional ULB detector | 5 sets |
| Omni-directional ULB detector | 1 set |
| Side scan sonar | 2 sets |
| Differential GPS | 3 sets |
| Remotely operated vehicle | 1 set |



Locating the Flight Recorder

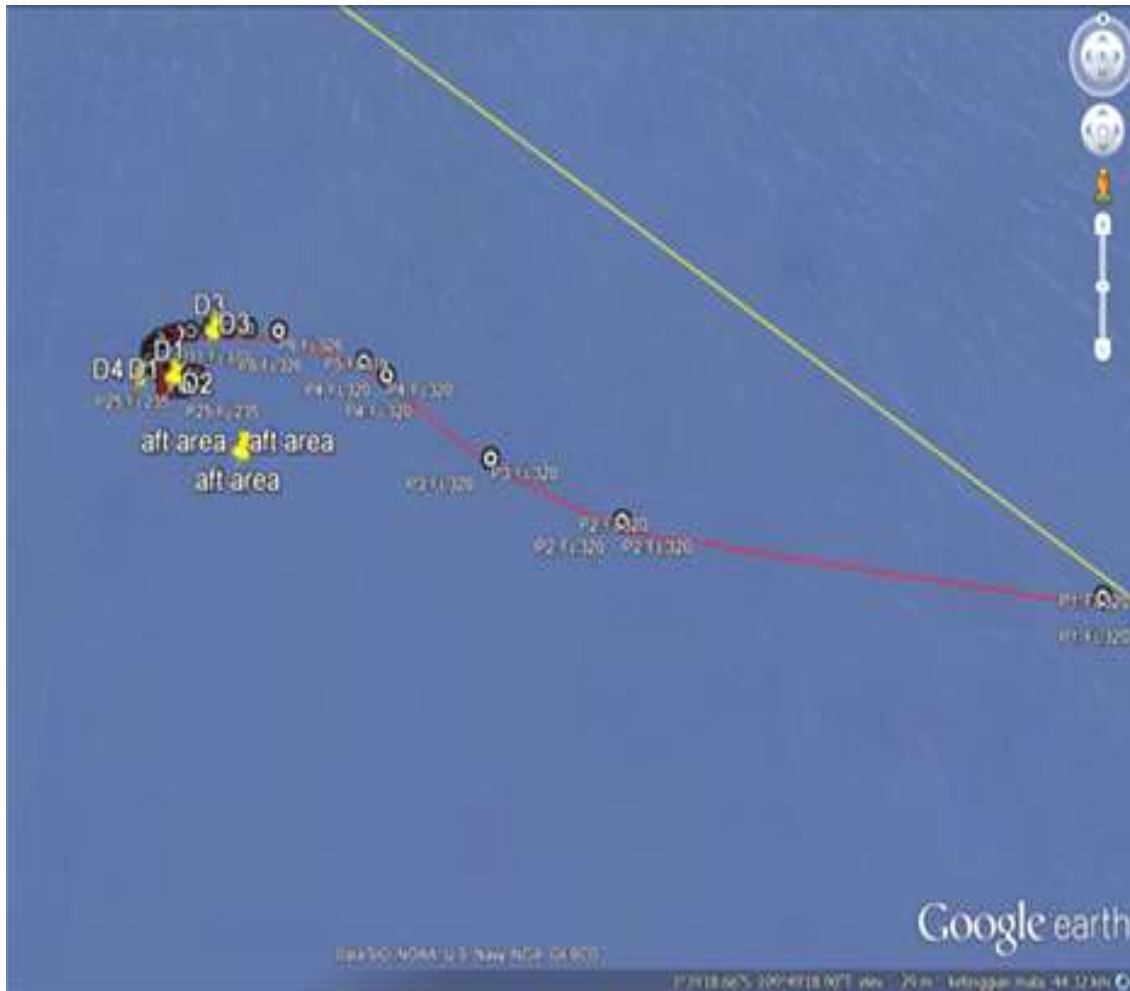
- **Plan (Location 1):**

- 3km x 3km square centred on last radar position
- Deploy ULB detector to detect/localise ping signal
- Deploy side scan sonar to pinpoint source of ping signal
- Search enlarged 12km x 12km area if nothing found

- **BASARNAS high probability area (Location 2)**

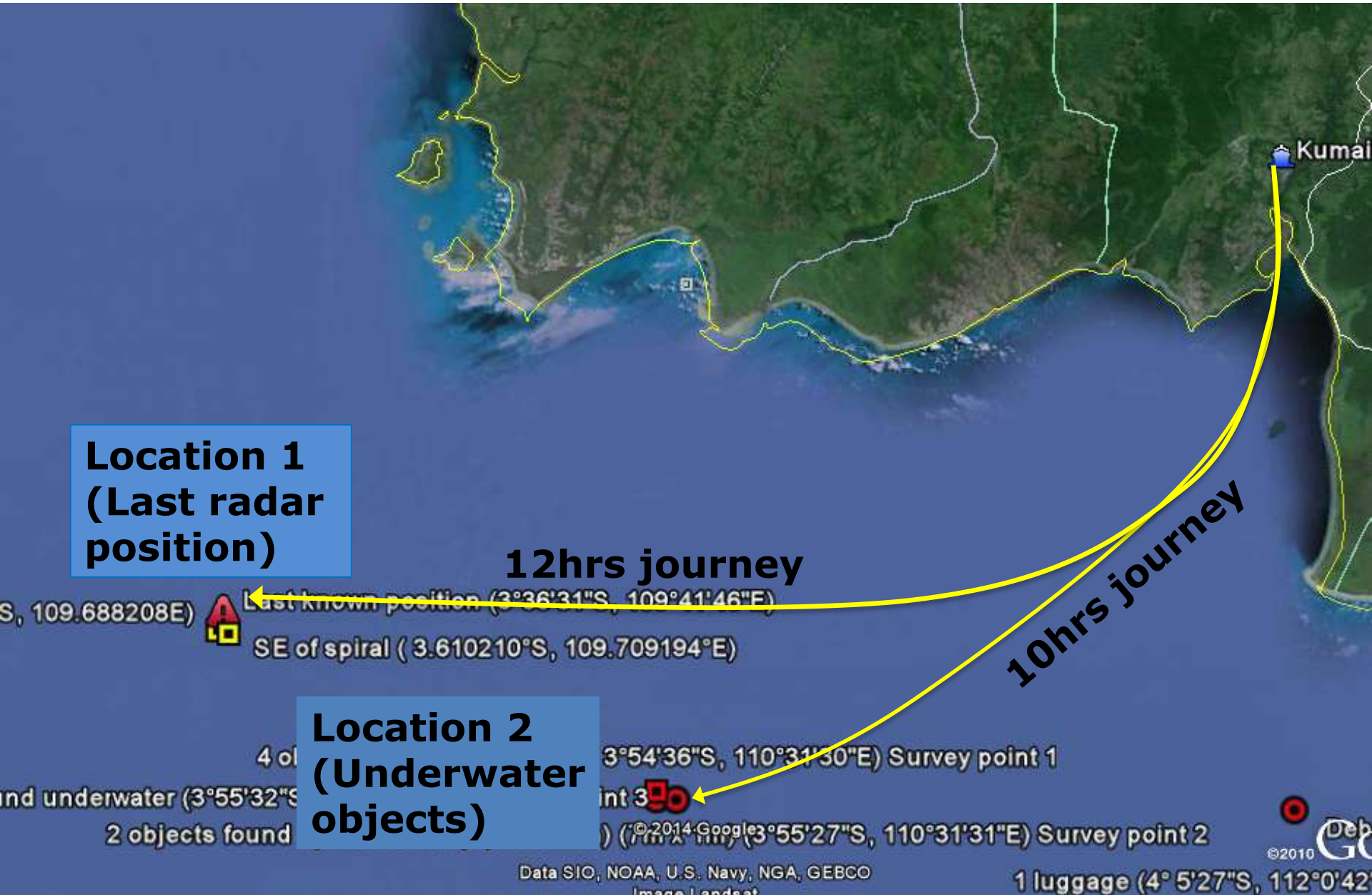
- Detour to perform ping signal detection while en-route to Location 1

Locating the Flight Recorder



- Last known radar contact based on ADS-B information
- Calculation made by team in Jakarta HQ (included NTSC, BEA & ATSB)
- Location 1 centred on calculated point

Locating the Flight Recorder



Locating the Flight Recorder

- **7 Jan 15:**

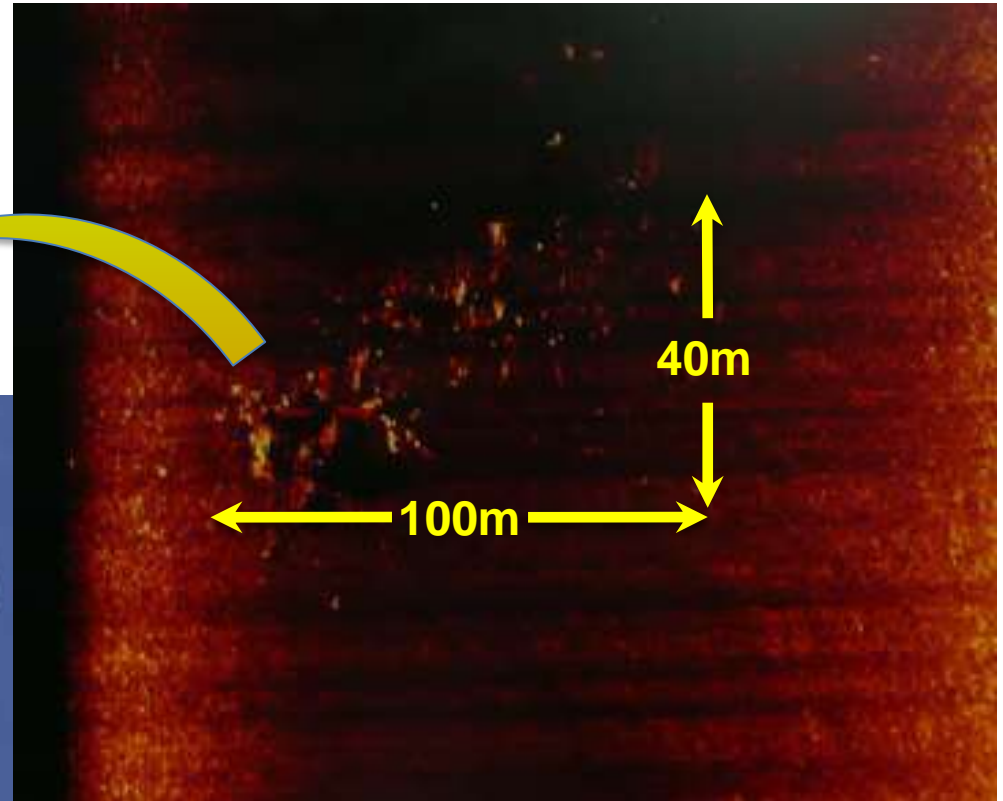
Jadayat

- 2 ping signals detected near last radar position
- Heard similar signals at 6 other locations
- Side sonar scan performed:
 - Contacts scattered over 100m x 40m area
 - Largest object 15m x 3m x 3m

Andromeda

- 1 ping signal detected near tail section location
 - Hear at first 4 listening locations, not detected in subsequent locations
 - Spectrum analysis found signal frequency at 37.5KHz
 - Tone sounded unusual, occurred at 2Hz instead of 1Hz
- No findings from side sonar scan

Locating the Flight Recorder



Estimated centre location from hydrophone listening results

Locating the Flight Recorder

- **8 Jan 15:**

- 2nd round of ping signal detection**

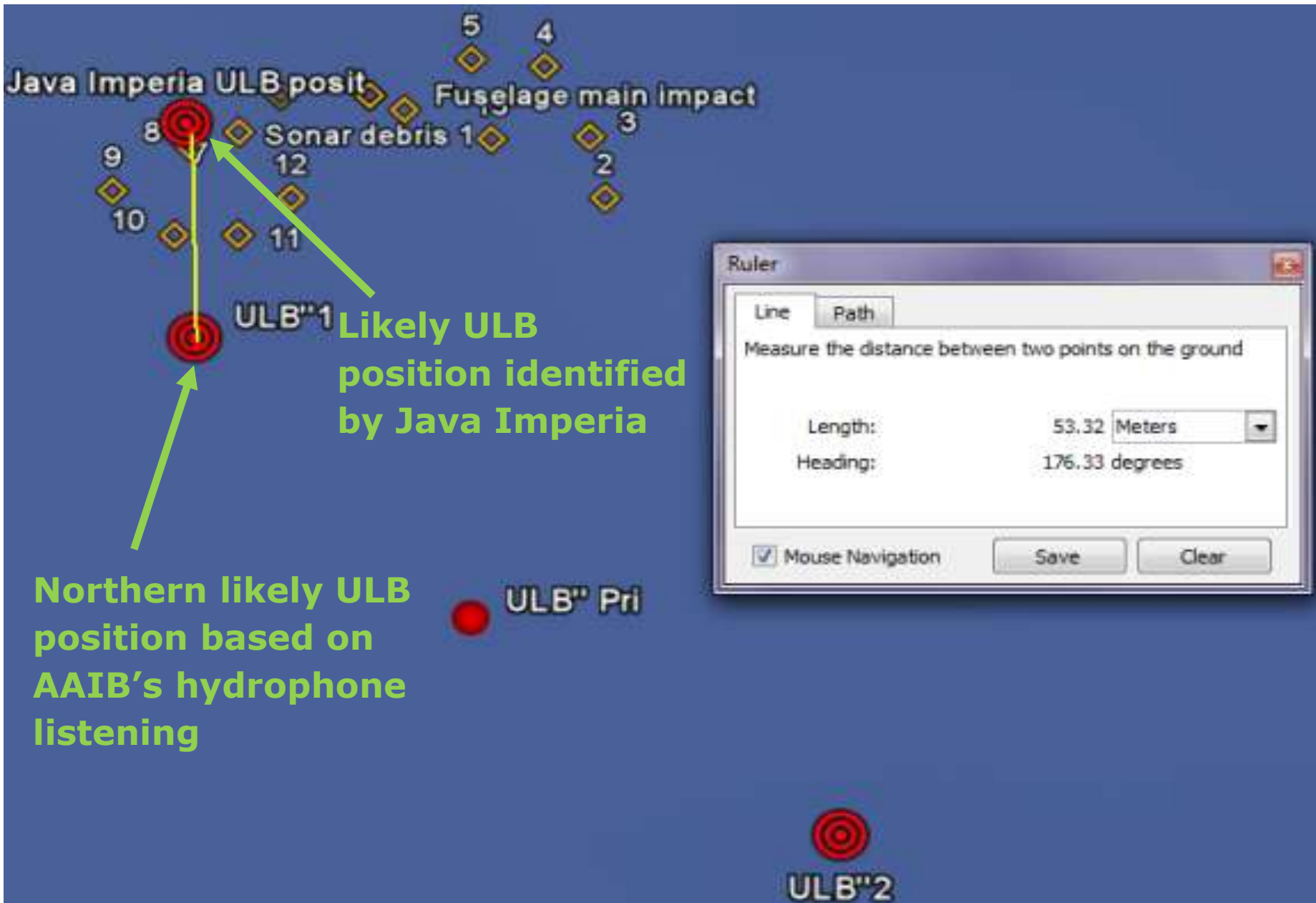
- Performed near last radar position
 - Presence of 2 ping signals confirmed, likely position further localised
 - AAIB's software suggested two possible ULB locations
 - One location 40m south of the possible debris field identified by side sonar scan

- **10 Jan 15:**

- Detection using Ultra Short Base Line System**

- Java Imperia installed with Sonardyne USBL system
 - Ping locating function detects ULB 37.5Khz
 - Identified 1 likely ULB location
 - Within side sonar scan debris field

Locating the Flight Recorder



Recovering the Flight Recorders

Recovering the Flight Recorders

- **Preparing the divers**
 - trained to operate ULB detector with 2 ping signals detection simulated
 - Briefed on flight recorders' location in aircraft
 - How flight recorders look like
 - Tips to locate flight recorders
- **9 Jan 15, dive operations commenced**
- **5 divers on board Jadayat**
 - Teams of 2 per dive
 - 15 mins per dive
 - Total dive time about 1 hour

Recovering the Flight Recorder



Recovering the Flight Recorders

- **ROV deployment**

- After divers reported hearing loud ping signals & seeing wreckage



Recovering the Flight Recorders

- **Lack of divers**

- NTSC requested for more diver
- Indonesia Navy supported request
- 14 divers available on 10 Jan 15
- 45 divers in total by 11 Jan 15

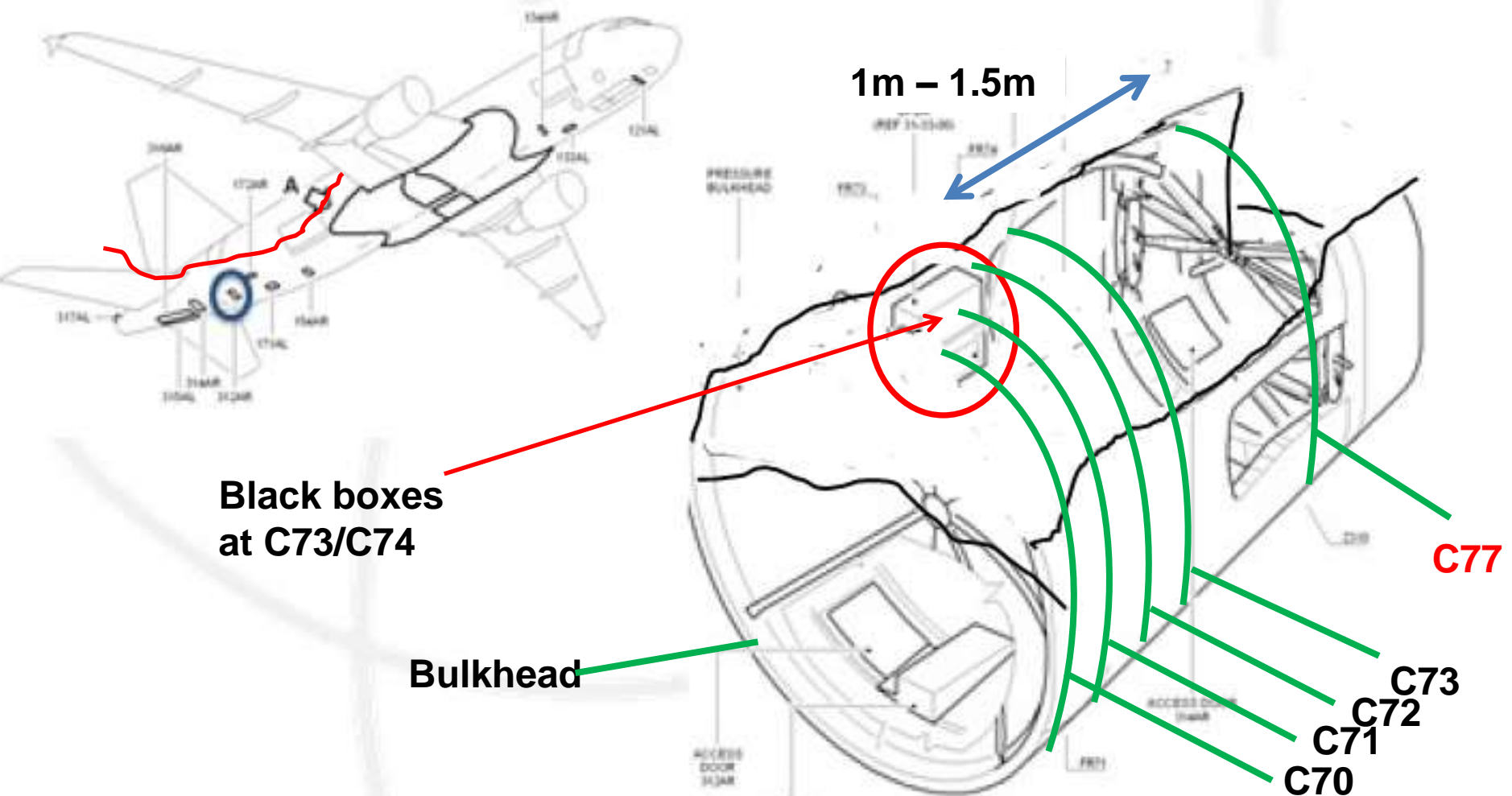
- **Dive operations continued on 10 & 11 Jan 15**

- Continue to detect 2 strong ping signals
- Appeared to originate from area below a large piece of wreckage

Recovering the Flight Recorders

- **2nd ROV deployment, 11 Jan 15**
 - ROV propulsion not switched on
 - Divers directed ROV to debris field to capture underwater image
 - Images of the empennage seen

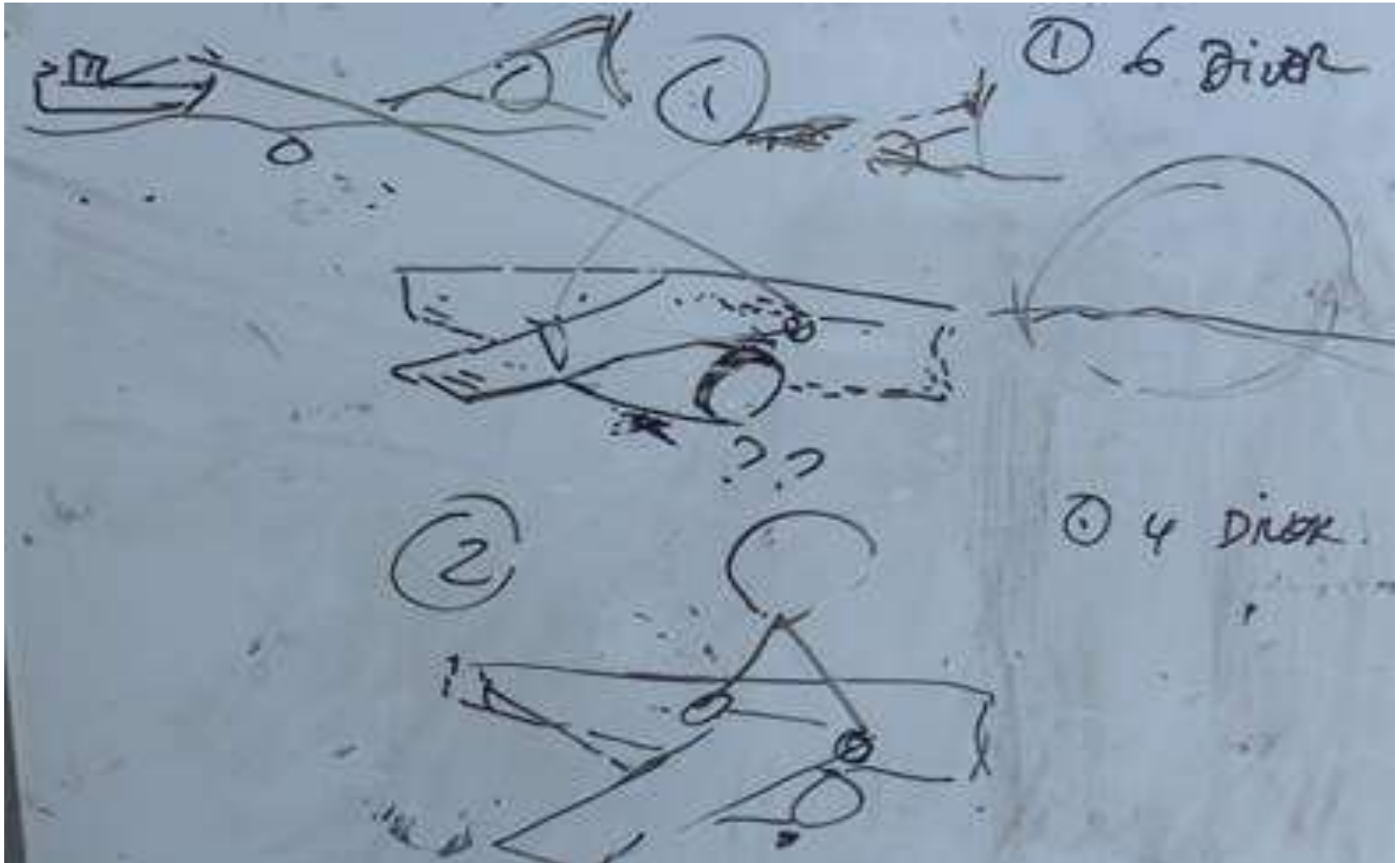
Recovering the Flight Recorders



- **Frame C77 seen in underwater footage**
- **Part of C70, C71, C72 recovered with tail section**

Recovering the Flight Recorders

- Preparation for lifting operations



Recovering the Flight Recorders

- **12 Jan, FDR recovered**
- **13 Jan, CVR recovered**

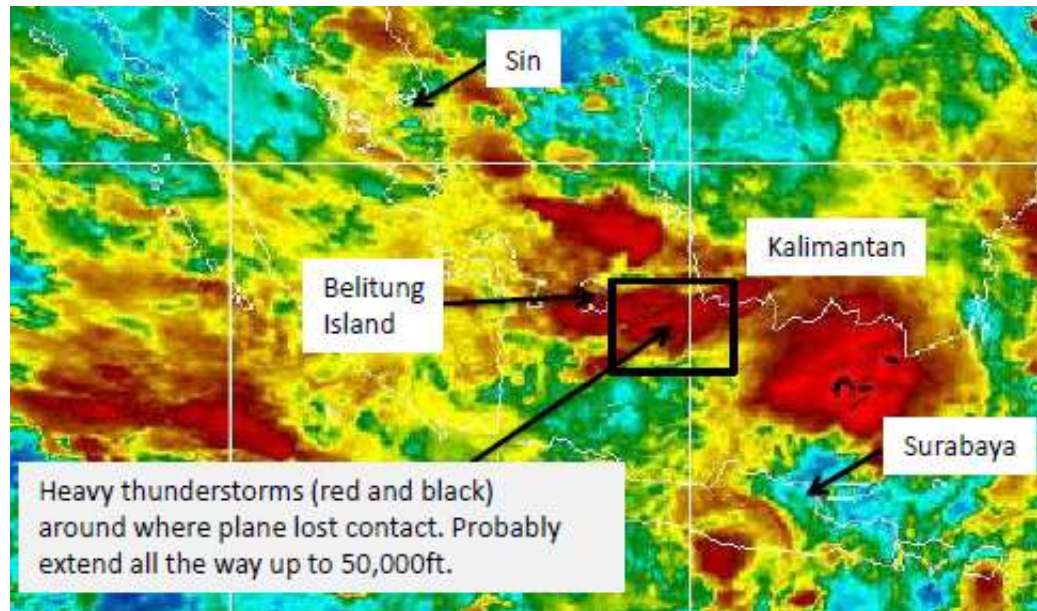


Challenges Faced

Challenges Faced

- **Weather**

- Reduced window to detect/localise pings
- Affected dive operations



- **Logistics**

- Planning for maximum endurance of vessels
- Trade travelling time for endurance

Challenges Faced

- **Accommodation**

- Lack of accommodation
- Improvising and staying onboard vessels



- **Transport**

- 400Kg of equipment
- Help from military and BASARNAS

Management of Sea Search

Management of Sea Search

- **SAR operation led by BASARNAS**
- **Flight recorder recovery coordinated by NTSC**
- **NTSC handled**
 - Overall management of underwater search team
 - Logistic support for underwater search team
 - Coordination with BASARNAS
 - Facilitation for necessary clearance required for foreigners

Management of Sea Search

- Assets available:

| Sea Operation | Vessels |
|---|---------|
| BASARNAS | 11 |
| Indonesia Navy | 21 |
| Indonesia Army | 1 |
| Indonesia Police | 12 |
| Indonesian Government Institutions | 7 |
| Ministry of Transportation | 11 |
| China | 1 |
| Japan | 2 |
| Malaysia | 5 |
| Singapore | 5 |
| United States | 2 |
| Total: 78 (63 Indonesia, 15 other States) | |

| Air Operation | Planes |
|---|--------|
| BASARNAS | 4 |
| Indonesia Military (Air Force, Army & Navy) | 19 |
| Ministry of Transportation | 1 |
| Indonesia Police | 4 |
| Australia | 2 |
| Japan | 2 |
| Malaysia | 1 |
| Russia | 2 |
| Singapore | 4 |
| South Korea | 1 |
| United States | 2 |
| Total: 42 (28 Indonesia, 14 other States) | |

International Cooperation

International Cooperation

- **BASARNAS received support from**
 - China
 - Japan
 - Malaysia
 - Russia
 - Singapore
 - South Korea
 - United States
- **NTSC received support from**
 - Australia
 - China
 - France
 - Russia
 - Singapore
 - United Kingdom
 - South Korea

International Cooperation

- **France**
 - State of Design and Manufacture
- **South Korea & Malaysia**
 - States having casualties
- **Australia, Singapore & UK**
 - Made offers directly to NTSC
- **China, Russia**
 - Contacted Indonesia Ministry of Foreign Affairs

International Cooperation

- **NTSC coordinated with MFA for necessary diplomatic clearance**
- **One NTSC personnel to each group of foreign participants**
 - Translator to communicate with locals
 - Coordinator with HQ
- **Search team able to focus on task**
- **Importance of close relation with counterparts**
 - Developed before crisis
 - Through attending ISASI seminars, ICAO AIG events

International Cooperation



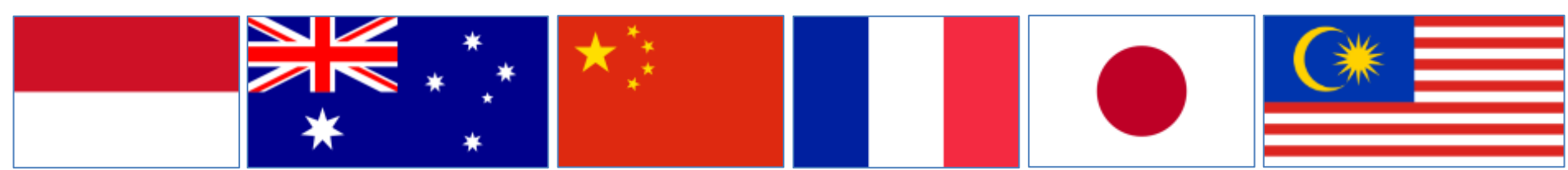
International Cooperation



Conclusion

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- **Successful operation based on international cooperation**
- **Beneficial to accept offer of assistance**
 - Greater efficiency for flight recorder recovery
 - Challenge to coordinate resources



Thank you

