Loss of ROKS CHEONAN

US Support to the Republic of Korea Joint Investigative Group 12 April through 24 May 2010

Rear Admiral Tom Eccles, USN
Chief Engineer, Naval Sea Systems Command and Senior US Representative to the ROK JIG
27 May 2010
Process

Sinking

Internal Explosion
- Magazine Explosion
- Fuel Tank Explosion
- Catastrophic Engine Failure

External Explosion

Surface & Above
- Surface Explosion
- Anti-ship Cruise Missile
- Ballistic

Under Water
- Torpedo
  - Under Keel
  - Contact
- Mine
  - Bottom
  - Moored Influence
  - Contact

No Explosion
- Grounding
- Collision
- General Hull Failure

Other
- Sub-surface IED
UNDEX Sequence

1. INITIAL EXPLOSION AND DEVELOPMENT OF GAS BUBBLE
   SHOCK WAVE REACHES VESSEL IN ~4ms AFTER DETONATION

2. FIRST HOG OF VESSEL RESULTING FROM GAS BUBBLE
   Reflected Shock Wave

3. VESSEL PROGRESSES TO FIRST SAG AS BUBBLE COLLAPSES

4. VESSEL AT FULL SAG AND BUBBLE JET DEVELOPS, CVK IS BROKEN
   Bubble Jet Forms

5. VESSEL AT SECOND HOG OCCURS WITH BUBBLE JET PENETRATION ~1.1 SEC AFTER DETONATION
Seismic – Acoustic Analysis

Recorded Signals

Calculated Bubble Period

Milestones

What Happened

Midsize Charge Fits Bubble Period and Observed Damage
UNDEX Modeling

Lethal area is much larger for 250 kg charge

Ultimate bending moment exceeded by larger charge
UNDEX Modeling

250kg charge @ Frame 65, 3m Port, 9m Depth

Measured deformation does not match model results

250kg charge @ Frame 75, 3m Port, 9m Depth

Measured deformation matches model results
UNDEX Modeling

250kg – Fr 77, 3m Port, 9m Deep

Total Deformation (centimeters)
(No Amplification on Deformed Shape)

Time : 0.0225
Cycle : 9874
Analysis indicates an underwater stand-off explosion, approximately at frame 75, 3m port of centerline, 6-9m depth, from a 200-300kg TNT equivalent charge.
수거 및 채증 과정  Recovery & collection

Critical evidence

⑧ 정밀감식  Precise examination
먼저 증거물 분석 Evidence analysis

어뢰 설계도면 Torpedo drawing

증거물 Evidence

결정적 증거물 (11/13)
Critical evidence
증거물은 북한에서 제조・사용중인 어뢰임

Evidence is the torpedo, which is produced and used in nK

<table>
<thead>
<tr>
<th>직경 Diameter</th>
<th>21인치(53.4cm)</th>
<th>길이 Length</th>
<th>7.35m</th>
</tr>
</thead>
<tbody>
<tr>
<td>폭 약 Charge</td>
<td>250kg</td>
<td>중량 Weight</td>
<td>1,700kg±10kg</td>
</tr>
<tr>
<td>항주거리 Range</td>
<td>10 ~ 15km</td>
<td>추적방식 Tracking method</td>
<td>음향항적・음향수동 Acoustic wake homing Acoustic homing</td>
</tr>
</tbody>
</table>
Summary

- First, Analyses Predicted:
  - 250 kg (+/- 50 kg) high explosive charge
  - Three to six meters below keel (6-9m deep)
  - Below the gas turbine engine room, at about Frame 75
  - About three meters to port of centerline
  - Most likely a torpedo
  - Possibly, but very unlikely, a moored influence mine

- Later, Recovered Torpedo After-body Matched Analyses
  - Same charge size
  - Recovered at the scene of the sinking

Experts Used Physical Evidence to Predict Cause, Then the Smoking Gun Was Found … And It Matched