STUDY OF A PORTABLE SEISMIC SYSTEM ONBOARD THE R/V ROGER REVELLE

SEISMIC WORKSHOP
STUDY OBJECTIVES

Can a portable seismic system on the Revelle provide similar capabilities to the Langseth?

- **Langseth Capability**
  - 6600 in³ source
  - 3,300 CFM compressor with 100% redundancy
  - Four source sub-arrays
  - **Streamers**
    - Existing SYNTRAK 1 x 8 km 4 x 6 km
    - New Sercel 1 x 15 km 4 x 8 km
STUDY OBJECTIVES

What size portable seismic system can fit on the Revelle?
STUDY ASSUMPTIONS

1. The system will not interfere with *Revelle’s* existing general oceanography missions

*Photo credit: Brett Longworth*
STUDY ASSUMPTIONS

1. The system will not interfere with *Revelle*’s existing general oceanography missions

2. Permanent modifications are expected to support the Portable Seismic System and correct interferences

*Photo credit: Brett Longworth*
STUDY ASSUMPTIONS

1. The system will not interfere with Revelle’s existing general oceanography missions
2. Permanent modifications are expected to support the Portable Seismic System and correct interferences
3. At least one large compressor will be installed permanently below decks

Photo credit: Brett Longworth
STUDY ASSUMPTIONS

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2. Permanent modifications are expected to support the Portable Seismic System and correct interferences
3. At least one large compressor will be installed permanently below decks
4. The seismic deck gear will be portable to and from the *Revelle* by using truckable components
STUDY ASSUMPTIONS

1. The system will not interfere with Revelle’s existing general oceanography missions
2. Permanent modifications are expected to support the Portable Seismic System and correct interferences
3. At least one large compressor will be installed permanently below decks
4. The seismic deck gear will be portable to and from the Revelle by using truckable components
5. The system is not portable between vessels due to the permanent compressor installation and other modifications
SEISMIC SYSTEM COMPONENTS

Source: 3300 in$^3$
1800 CFM air supply

- Three compressors to supply with redundancy
  - 1 x LMF 51 electric drive compound compressor supplying 1800 CFM
  - 2 x LMF 21s electric drive compressors supplying 750 CFM each – containerized

Shot Rate: 10 seconds
SEISMIC SYSTEM COMPONENTS

Streamers:
- Two 4 km Streamers
  - Waterfall winch arrangement
  - 4 spools of spare streamer stowed on deck
R/V REVELLE SEISMIC STUDY

What was examined?

- Arrangements
- Stability
- Power & Tow capacity
## ARRANGEMENTS

### Equipment

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 x Port Source</td>
<td>ISO 40 ft</td>
</tr>
<tr>
<td>1 x Port Gun Rail</td>
<td></td>
</tr>
<tr>
<td>2 x LMF 21s Compressors (750 CFM)</td>
<td>ISO 20 ft</td>
</tr>
<tr>
<td>1 x LMF 51 Compressor (1800 CFM)</td>
<td>Skid Mounted</td>
</tr>
<tr>
<td>1 x Compressor phase shift Xfmrs, speed controller</td>
<td>ISO 20 ft</td>
</tr>
<tr>
<td>2 x Streamer Winces</td>
<td>Skid Mounted</td>
</tr>
<tr>
<td>1 x Hydraulics/compressor parts-workshop van</td>
<td>ISO 20 ft</td>
</tr>
<tr>
<td>1 x Recording lab</td>
<td>ISO 20 ft</td>
</tr>
<tr>
<td>1 x Source workshop</td>
<td>ISO 20 ft</td>
</tr>
<tr>
<td>1 x High pressure manifold and buffer bottles</td>
<td>Skid Mounted</td>
</tr>
<tr>
<td>4 x Streamer spares</td>
<td></td>
</tr>
<tr>
<td>1 x HPU</td>
<td>ISO 20 ft</td>
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</tbody>
</table>
ARRANGEMENTS

Top view
ARRANGEMENTS

Large compressor location
ARRANGEMENTS
## STABILITY

### Load Case

<table>
<thead>
<tr>
<th>Item No</th>
<th>System</th>
<th>Weight (st)</th>
<th>LCG (ft aft of FP)</th>
<th>TCG (ft stbd of CL)</th>
<th>VCG (ft ABL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hydraulics/compressor parts-workshop van</td>
<td>9.00</td>
<td>200.00</td>
<td>20.70</td>
<td>30.50</td>
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<td>2</td>
<td>Seismic air compressor (750 CFM)</td>
<td>16.00</td>
<td>57.00</td>
<td>6.00</td>
<td>47.00</td>
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<tr>
<td>3</td>
<td>Seismic air compressor (750 CFM)</td>
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<td>57.00</td>
<td>18.00</td>
<td>47.00</td>
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<tr>
<td>4</td>
<td>Seismic air compressor (1800 CFM)</td>
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<td>170.00</td>
<td>-12.00</td>
<td>21.00</td>
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<tr>
<td>6</td>
<td>Compressor phase shift Xfmr, speed controller</td>
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<td>185.00</td>
<td>-12.00</td>
<td>30.50</td>
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<tr>
<td>7</td>
<td>High pressure manifold and buffer bottles</td>
<td>2.50</td>
<td>187.00</td>
<td>21.00</td>
<td>28.50</td>
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<td>8</td>
<td>Recording lab</td>
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<tr>
<td>9</td>
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<td>Port Gun Rail</td>
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<td>-21.50</td>
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<td>14</td>
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<td>15</td>
<td>Streamer winch 1</td>
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<td>-3.00</td>
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<td>16</td>
<td>Streamer winch 2</td>
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<td>31.50</td>
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<td>17</td>
<td>HPU’s</td>
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<td>177.00</td>
<td>20.70</td>
<td>30.50</td>
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<td></td>
<td>Total Mission Loadout</td>
<td>186.50</td>
<td>176.49</td>
<td>-0.21</td>
<td>35.72</td>
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</tbody>
</table>
STABILITY

Results

- Can meet stability requirements
- Anti-roll tank must be empty
- Needed to move items to starboard to balance vessel list in burn out condition
POWERING

Powering estimate is based on midlife repower of the *Thompson*

- **Installed power**
  - 2 x 2100 ekW generators
  - 2 x 940 ekW generators
  - 6080 ekW Total
- **Required Power for house and propulsion**
  - 2475 ekW for normal transit condition
Powering estimate is based on midlife repower of the Thompson

- **Required Power for Seismic**
  - ~2500 ekW total installed
  - ~1300 ekW most likely scenario

- **Available Power for seismic**
  - 6080 ekW – 2475 ekW = 3605 ekW
  - In most cases have one large generator spare during seismic operations
SUMMARY

- It is not possible to match the capability of the seismic system of the Langseth in a portable system aboard the Revelle or Thompson.
- Maximum capacity of portable system on Revelle / Thompson is:
  - 3300 in³ source
  - 1800 CFM compressor capacity
  - Two source sub-arrays with 10 second shot rate
  - Two 4 km streamers
Zoom = mouse wheel             Rotate = left click + drag             Pan = ctrl + left click + drag