Safety Aloft
Overview

1. The 1997 ASTA/ISTA Safety Forum
2. The Two Surveys: ‘97 & ‘13
3. Incidents/Accidents while Aloft
4. Regulations: What our vessels/organizations are required to do to prevent accidents and manage risk.
5. The Physics of Falling (and stopping)
6. Policies, Procedures, & Training
7. Safety Equipment and Gear
Capt. O’Brien: “We can do a better job of protecting our sailors that go aloft”

• Regulations – What is required on Sailing School Vessels? How does this compare to shore side work at heights?
• Safety Practices and Related Equipment
• A survey of member vessels

Capt. Manfred Hovener:
• Modifications to the rig to minimize risk: vertical wire @ platforms, large dia. foot ropes, safety wire on yards, short tethers, extra buntlines and modified clewlines (take sail from deck).
• Comprehensive policy and standing orders for going aloft or on the bowsprite.
Captain Chris Baranowski:
• Emphasized the importance of the sail training experience, specifically character building. An important component being going aloft.
• Reinforced the efforts of Capt. Hovener

Captain Frank Scott:
1. Spoke to specifics regarding safety aloft: Futtock shrouds, lubber’s holes, jacklines, harsnesses, skylarking, experience, fitness/health, and rigging.
2. Accident statistics and accident reports.
3. Comments on working on the bow sprit and aboard fore and aft rigged vessels.
### ASSESSING RISK

<table>
<thead>
<tr>
<th>Likelihood of Harm</th>
<th>Slight Harm</th>
<th>Moderate Harm</th>
<th>Extreme Harm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Unlikely</td>
<td>Very Low Risk</td>
<td>Very Low Risk</td>
<td>High Risk</td>
</tr>
<tr>
<td>Unlikely</td>
<td>Very Low Risk</td>
<td>Medium Risk</td>
<td>Very High Risk</td>
</tr>
<tr>
<td>Likely</td>
<td>Low Risk</td>
<td>High Risk</td>
<td>Very High Risk</td>
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</tbody>
</table>

What is the vessel type? Fore and Aft rig = 42%  
Square Sail Rig = 58%

How many tethers are used with the harness? 1 = 58%  
2 = 42%

Information regarding the type of lanyard/tether used?  
-Webbing, 3 strand, double braid  
nylon, Samson (polyester?),  
manufactured webbing, locally  
spliced, double braid knotted,  
cordlette & prussik.  
100%

Is a fitness test required before going aloft? Yes = 42%  
No = 58%

How are crew and students trained for going aloft?  
Written policy and procedure for professional crew  
58%

On site briefing/training prior to going aloft.  
-SHock absorbing gear (2 vessels ‘97 & ‘13)
Falls from Aloft: (Fatalities)

Appledore – January 2012
Gorch Fock (German) – November 2010
Star of India – July 2010
TS Royalist (UK) – May 2010
Alabama – July 2006
Constitution – July 2004
TS Albatross (Dutch) – August 2004
USCG Eagle – June 1998
CFR 46 Shipping Regulations

Part 169 Sailing School Vessels

Who regulates working at heights on our vessels? USCG (see MOU – USCG/OSHA)

§ 169.723 Safety belts. Each vessel must carry a harness type safety belt conforming to Offshore Racing Council (ORC) standards for each person on watch or required to work the vessel in heavy weather.

§ 169.825 Wearing of safety belts.

The master of each vessel shall ensure that each person wears an approved safety harness when aloft or working topside in heavy weather.
IV.B.3. Safe work practices

a. Personnel to be trained. Each vessel owner/operator needs to provide training in safe work practices to all personnel conducting hazardous job tasks or working in hazardous locations.

Body Belts
- As of January 1, 1998, use of a body belt for fall arrest is prohibited by OSHA
  - Damage to spine and internal organs
  - Average tolerable suspension time is 90 seconds
  - Maximum of only 900 pounds of arresting force
THE PHYSICS OF FALLING
(AND STOPPING!)

If an object of a certain mass (in kg) is dropped a specific height (in m) it will reach a determined velocity (m/s) due to the acceleration of gravity (g), developing a kinetic energy (KE) just prior to impact or being arrested, as in falling tethered to a fixed anchor.

This alone does not inform us of the force generated until we factor in the distance (d) traveled after impact (coming up short on the tether).

Applying the work-energy principle we can calculate that force (F) = work(W)/d

**Impact velocity (Stopping velocity)**

\[ V = \sqrt{2gh} \]

**KE converts to W (work)**

\[ W = Fd \]

\[ KE = mgh \]

\[ KE = 0 \]

\[ KE = \frac{1}{2}mV^2 \]
170 lb. crew (77 kg)
6 ft. tether
10 ft. fall (3.048 m)
5 in. stretch in gear (.13 m)

Will generate a force of

3983 lbs.

18 kN
Consider your safety system:

• Harness
• Tether
  - Static or Dynamic (effects d)
  - Decelerator/Absorber (increases d)
• Clips
• Anchor Points:
  - Vertical Wire (potentially increases h)
  - Horizontal Wire (CAUTION!)
(6) Horizontal lifelines may, depending on their geometry and angle of sag, be subjected to greater loads than the impact load imposed by an attached component. When the angle of horizontal lifeline sag is less than 30 degrees, the impact force imparted to the lifeline by an attached lanyard is greatly amplified. For example, with a sag angle of 15 degrees, the force amplification is about 2:1 and at 5 degrees sag, it is about 6:1. Depending on the angle of sag, and the line's elasticity, the strength of the horizontal lifeline and the anchorages to which it is attached should be increased a number of times over that of the lanyard. Extreme care should be taken in considering a horizontal lifeline for multiple tie-offs. The reason for this is that in multiple tie-offs to a horizontal lifeline, if one employee falls, the movement of the falling employee and the horizontal lifeline during arrest of the fall may cause other employees to fall also. Horizontal lifeline and anchorage strength should be increased for each additional employee to be tied off. For these and other reasons, the design of systems using horizontal lifelines must only be done by qualified persons. Testing of installed lifelines and anchors prior to use is recommended. (OSHA Personal Fall Arrest Systems - Non-Mandatory Guidelines for Complying with 1926.502(d))
Policy, Procedure, and Training

Policy (required):
• Introduction/Overview (square rig or fore & aft?)
• Safety
• Training and Certification for going aloft:
  - Crew
  - Trainees/students
  - Fitness
• Rules for laying aloft or on bow sprit
• Specifics for the type of rig and vessel safety systems
  - Working on yards, futtock shrouds, crosstrees.
Safety Gear and Equipment

Harnesses

Tethers and Clips

Anchors

Fall Protection Equipment Inspection
• Inspect before every use
• Cuts, tears, abrasions, stitches coming out
• Cracks or burrs
• Parts move freely
• No alterations
• Appropriate labels
• Periodic inspections should be done on fixed
  fall protection systems (record)
Summary
• Understand and recognize potential hazards of working aloft.
• Develop policies, practices, and training for crew and students going aloft.
• Wear a harness appropriate to the task. Adjust properly.
• Reduce arresting forces by limiting fall distance
• Use decelerate devices to reduce arresting forces
• Consider the need to rescue workers who fall and are held suspended
• Inspect your fixed equipment prior to use