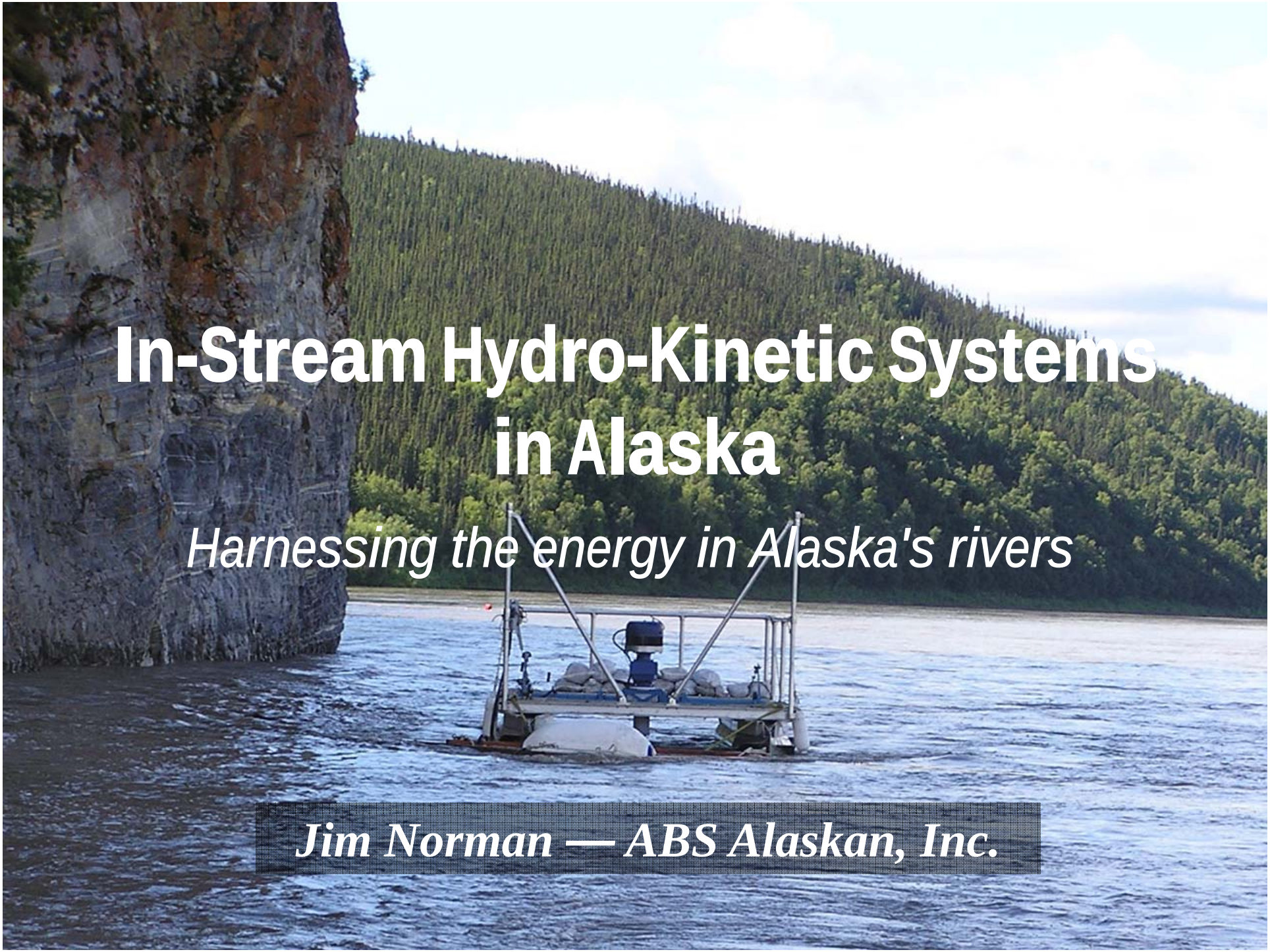


In-Stream Hydro-Kinetic Systems in Alaska

Harnessing the energy in Alaska's rivers

Jim Norman — ABS Alaskan, Inc.

Traditional Hydro Systems

Closed System: Water enters a pipe on one end and exits into the turbine at the other end = control of the water

Two critical components are Head & Flow:

- *Head – Difference in elevation between the pipe inlet and outlet = pressure = amount of potential energy in a unit of water (ie. gallon or cubic foot)*
- *Flow – Number of units of water passing through the turbine (gallons per minute or cubic feet per second)*
- *Reliable, stable and cost effective*

Hydro-Kinetic Systems

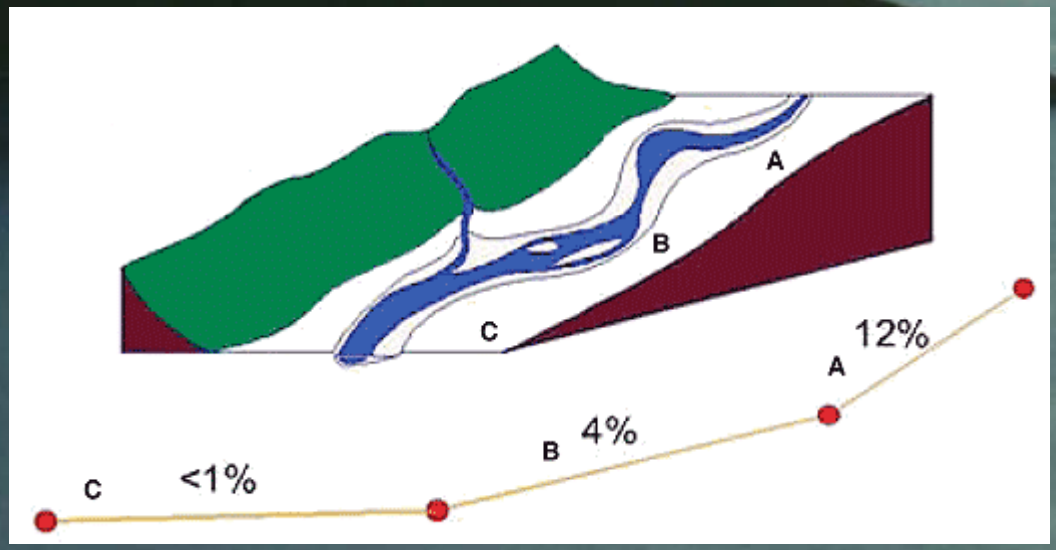
Open system – captures energy in free-flowing water
Gravitational pressure only, so higher flow volume needed

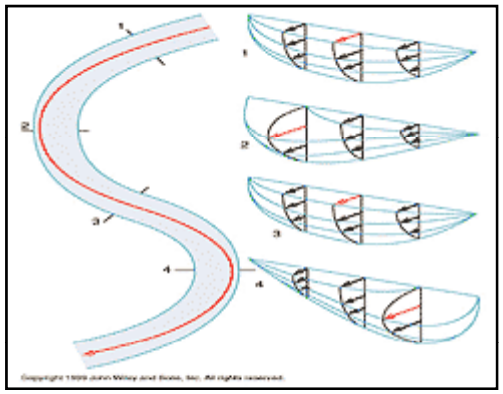
- More vulnerable to nature
- More impact on surroundings

- Requires different initial resource assessment process when selecting sites
- Resource shares some characteristics of wind (speed and swept area)
- Water velocity is critical – Potential = speed^3

What affects velocity (speed)?

Stream gradient (slope of the land) – A steeper gradient produces higher water velocity





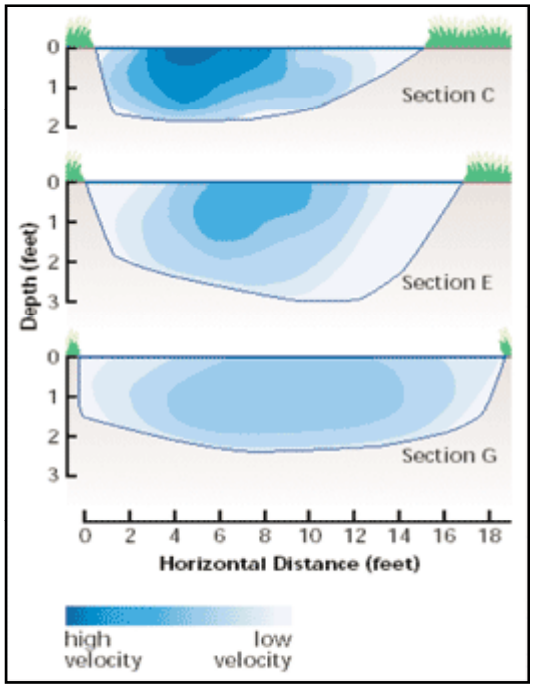
- *Alignment: straight channel = less friction*

- *Contour: Point farthest from river bed generally has less friction & higher speed*

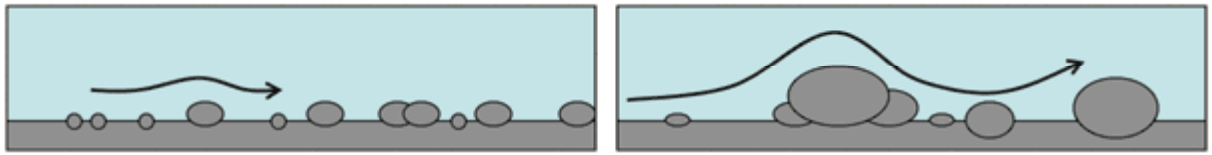
- *Cross-section: Sections of river with small cross-sectional area generally = faster water*

- *Water depth: Generally highest velocity in the area of 10–30% river depth*

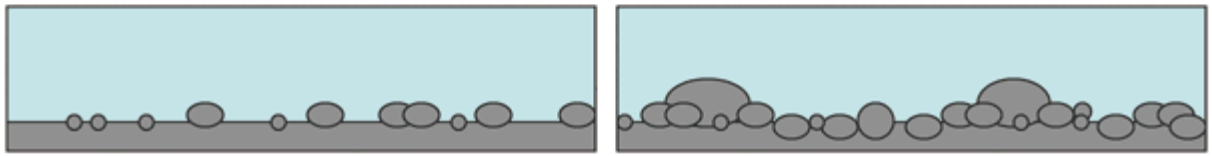
- *Discharge volume: Periods of higher volume (rain or snow melt) have higher velocities*



River bottom terrain – Rough river beds create friction & turbulence



low roughness & less turbulence vs. high roughness & greater turbulence



Ruby – Getting Our Feet Wet

Winter 2007, Product Search – Looking for "water to wire" systems: New Energy Corp EnCurrent turbine

Funding – Yukon Inter-tribal Watershed Council grant

March 2008 – Project was underway

Site – Review of several sites. Ruby selected. Reasonable resource and good community support.

Very much a "design & build" project. Many questions, but few established answers.

Goal – To prove that a hydro-kinetic system could be installed, consistently produce power, and export that power to the community grid.

July 23, 2008: Equipment sent to Ruby via Nenana

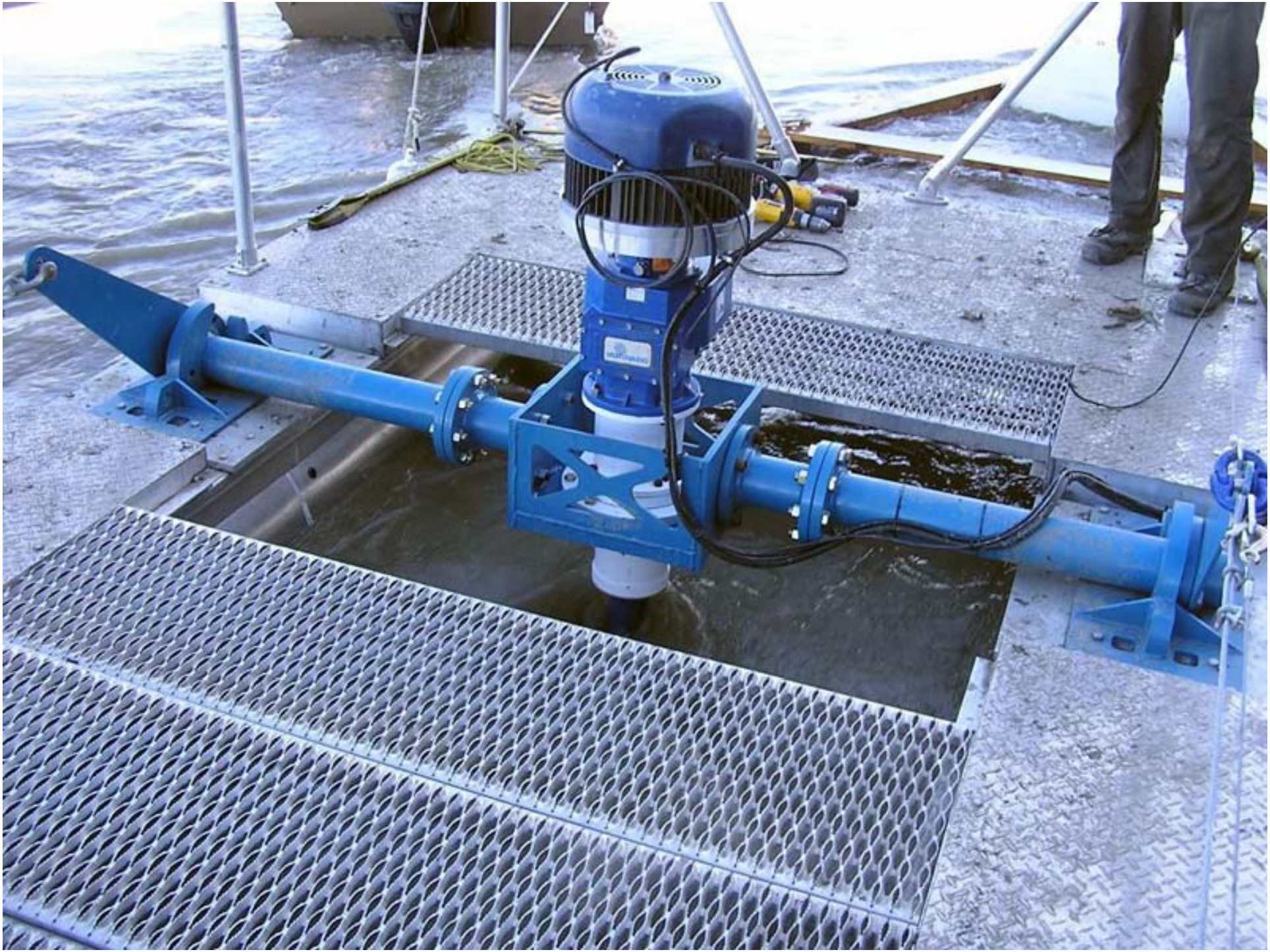
Aug. 2, 2008: Installation started

One week later: System was fully operational


YAMAHA


YAMAHA
90


AURORA
ON
COGEN
DISCONNECT
OFF



Alaska Power & Telephone Eagle Project

25kW EnCurrent turbine on a pontoon barge in the channel between Eagle & Bell Island

Alaska Power & Telephone Eagle Project

25kW EnCurrent turbine on a pontoon barge in the channel between Eagle & Bell Island

Two scenarios to be tested:

- *Direct grid-tie support for the Eagle electrical grid*
- *Stand-alone system – hydro as prime power for test grid*

Adds complexity to the control system

Control and monitoring equipment contained in 20ft. connex

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Control and monitoring equipment contained in 20ft. connex

Deployment scheduled for the latter part of May

Will be first commercial grid scale hydro-kinetic system in Alaska

What is Necessary for a Successful Hydro-Kinetic Program?

- *The water resource – Velocity and proximity*
- *Appropriate system size and cost*
- *System portability – Ease of deployment and retrieval*
- *Inexpensive site and resource assessment*
- *A database of baseline river interaction data (fish, etc.)*
- *A streamlined permitting process*

Jim Norman — ABS Alaskan, Inc.