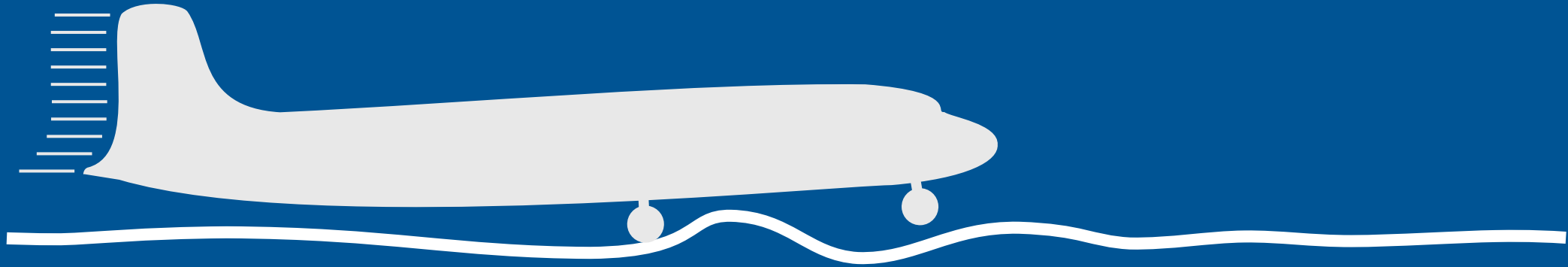


FAI Float Pond Ice Landing Experiments

Winter 2024-25



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Goal

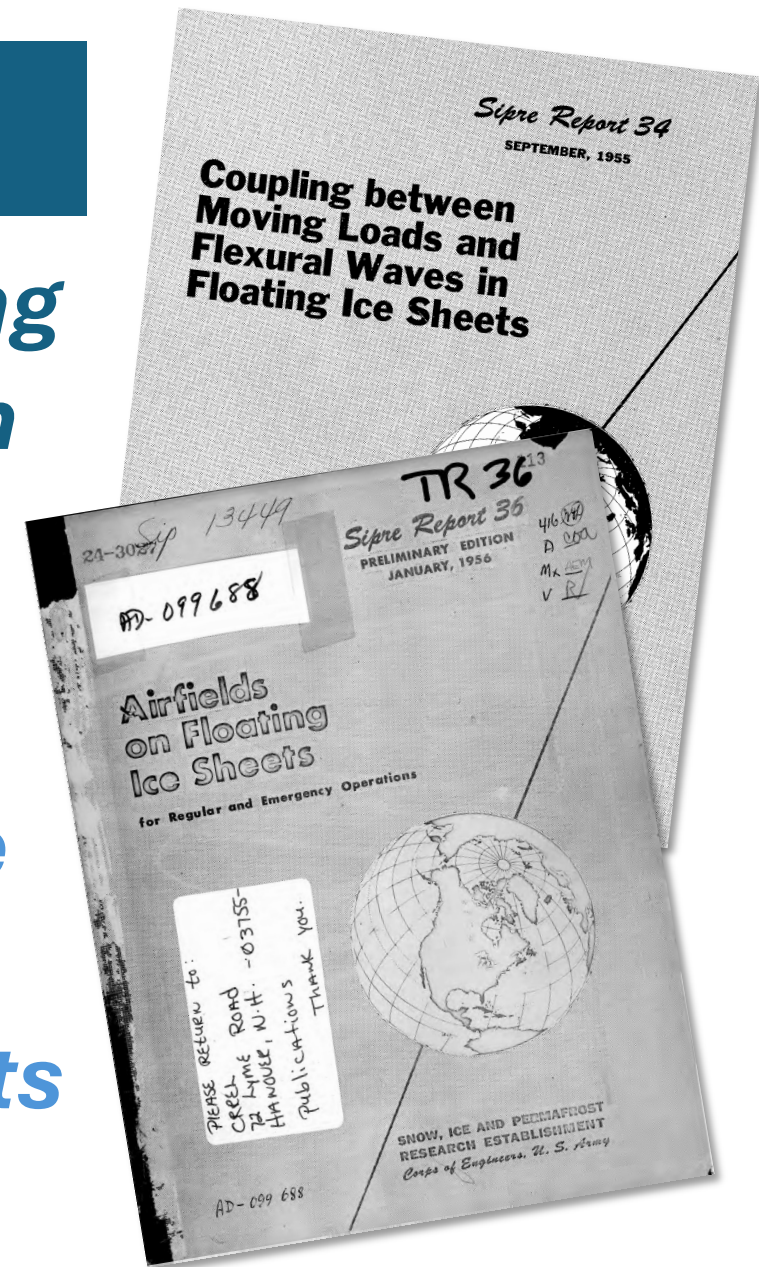
Combine state-of-the-art science with the expertise of local operators in Fairbanks to advance the safety of floating ice runway operations

Background

Standards for landing aircraft on floating ice are largely based on 1950s research

Relatively little new research since, but:

- ***Local Fairbanks operators have amassed a wealth of knowledge in the intervening decades***
- ***Modern instruments allow experiments that were not previously possible***



Theory I

- **Static bearing strength depends on ice thickness**

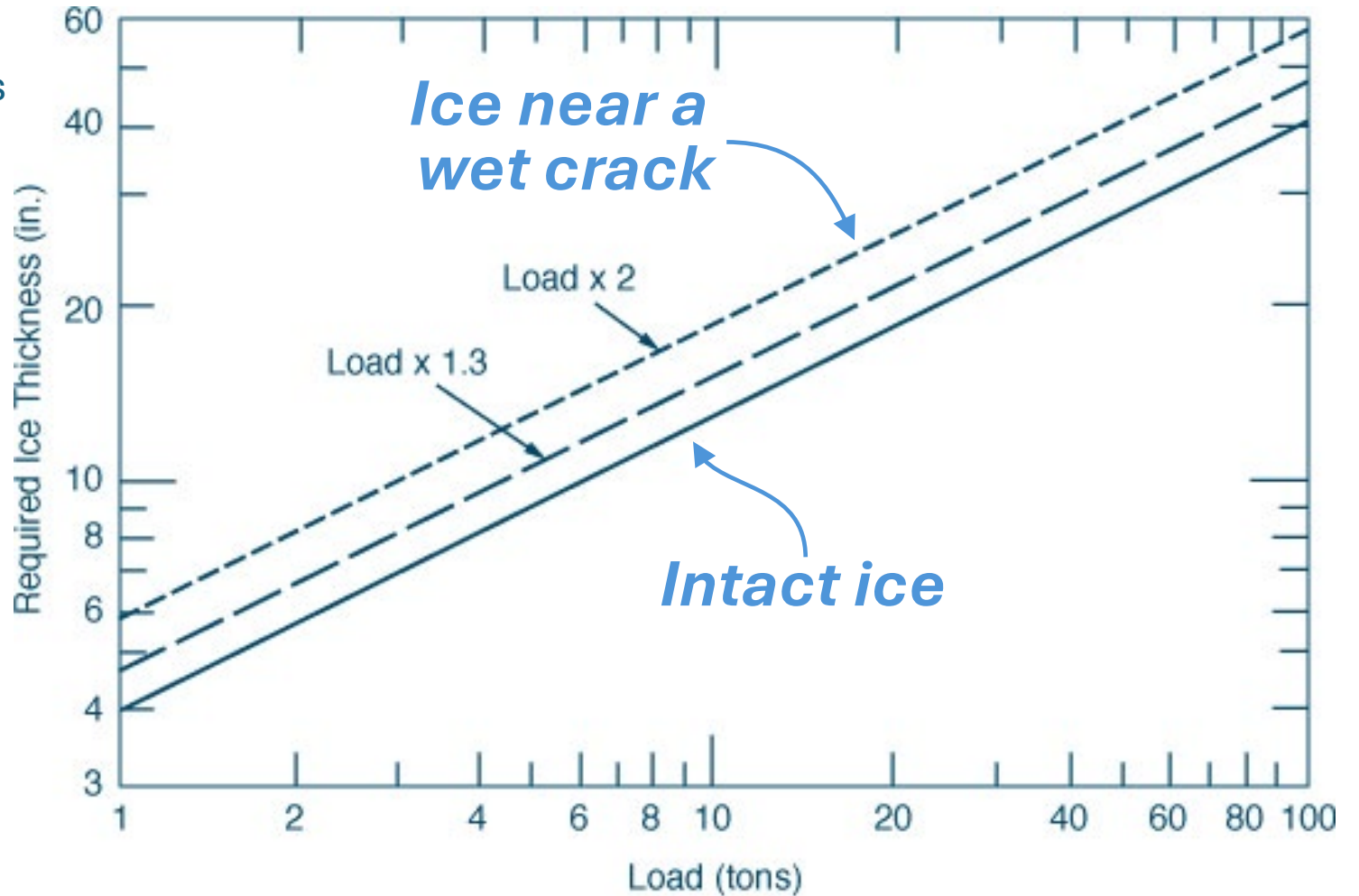
Bearing capacity (tons) $\rightarrow P$

Ice thickness (inches) $\rightarrow h$

$$P \approx \frac{h^2}{4}$$

Applies to intact ice only

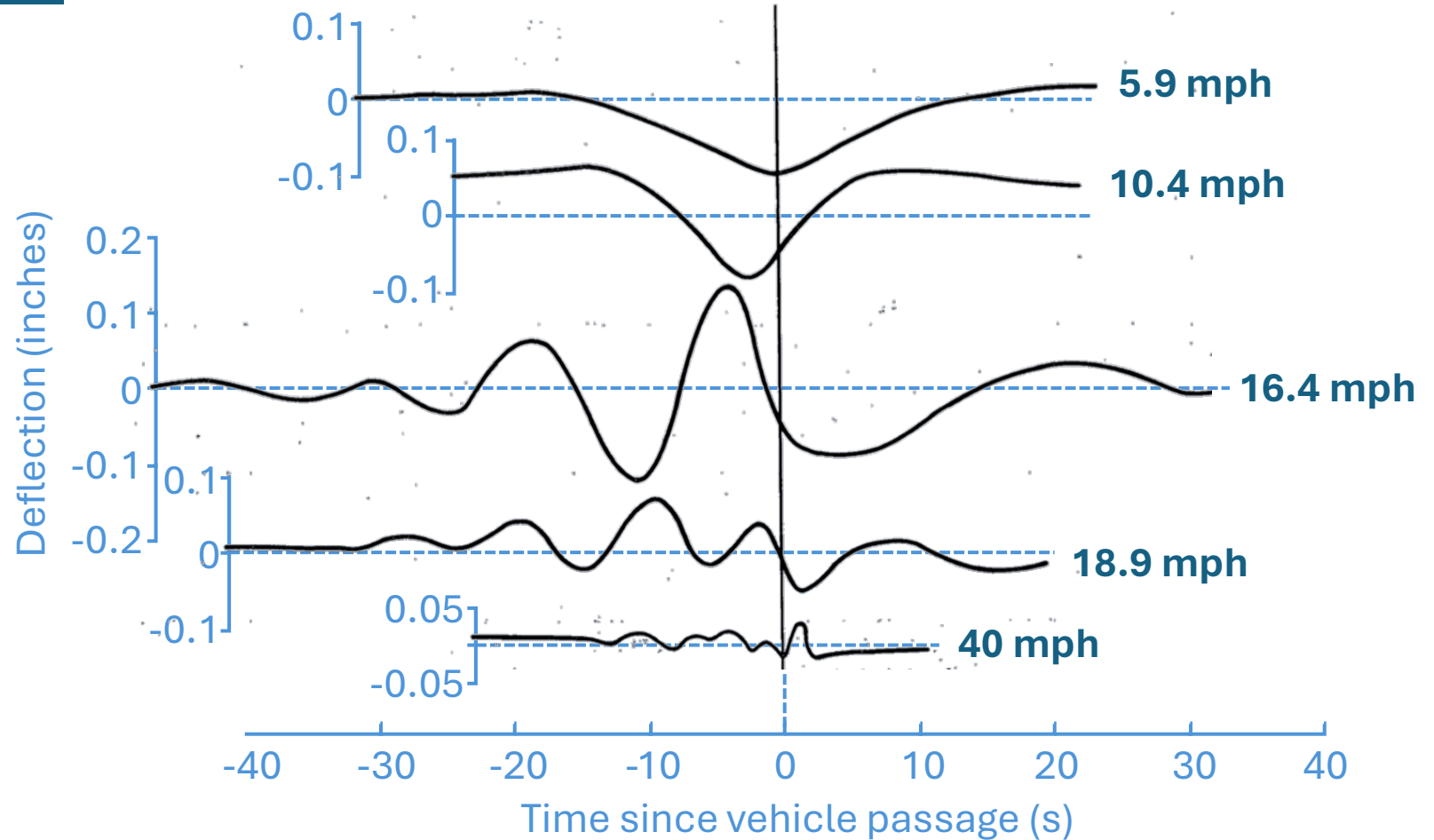
From U.S. Army Cold Regions Science and Engineering Lab (CRREL)
SAFETY ON FLOATING ICE SHEETS



Theory II

- Moving loads create flexural waves
- At critical speed, waves become resonant
- If the wave gets too big, it will break the ice

6000-lb weapon carrier on 2-ft of ice in 10-ft of water



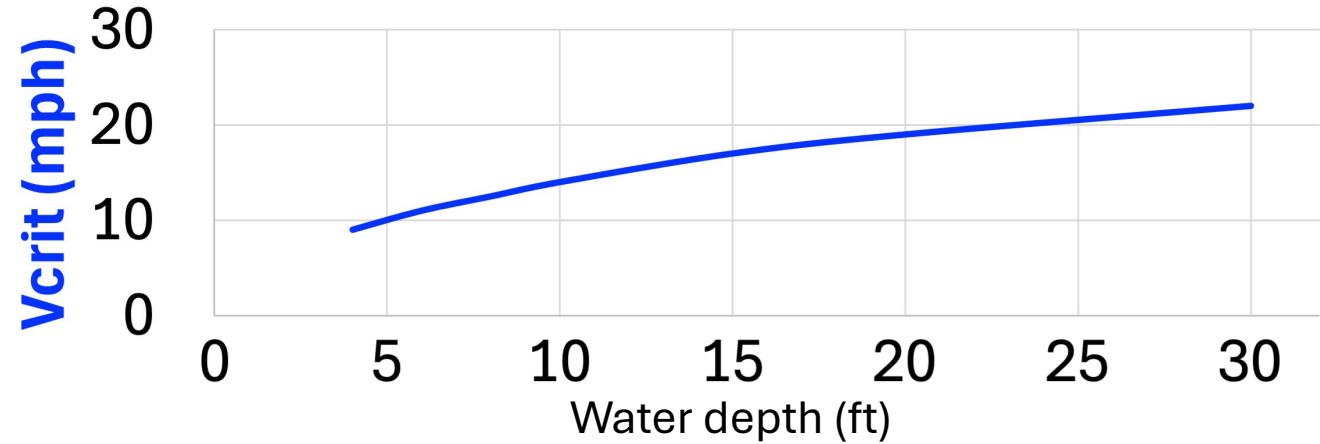
From Wilson (1955) SIPRE Tech Report #34

Theory III

Shallow water:

- V_{crit} depends on water depth
- Taxiing speeds

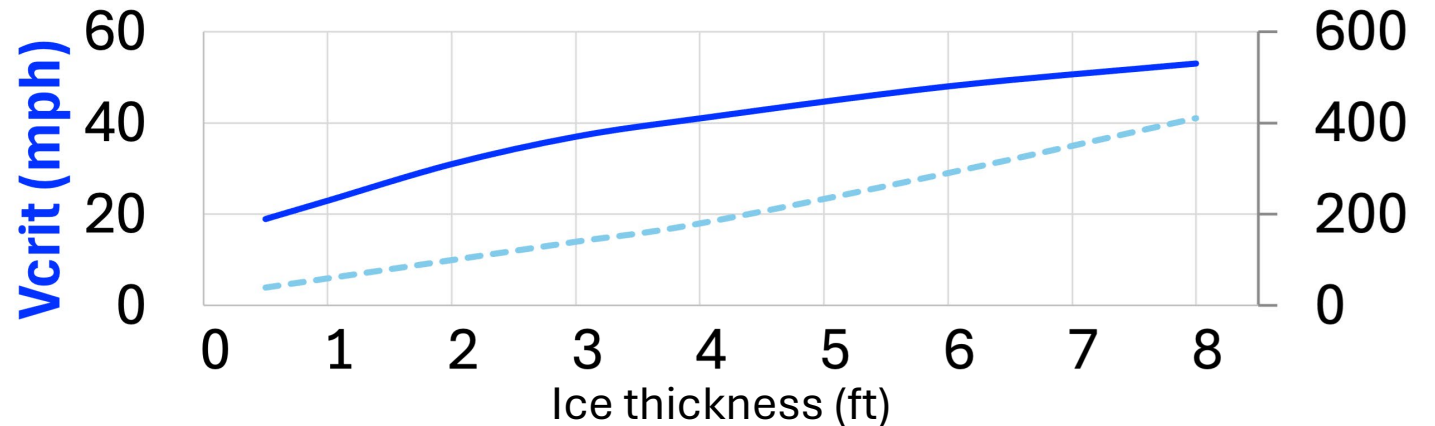
Water depth (ft)	4	6	8	10	15	20	30
V_{crit} (mph)	9	11	12	14	17	19	22



Deep water:

- V_{crit} depends on ice thickness
- Ground roll speeds

Ice thickness (ft)	0.5	1	2	3	4	6	8
Minimum depth (ft)	40	60	100	140	180	290	410
V_{crit} (mph)	19	23	31	37	41	48	53



Preliminary research questions

- How well can we measure flexural waves created during takeoff and landing?
- How do the flexural properties of the ice change between winter and spring?
- Do the flexural properties change after multiple landings?

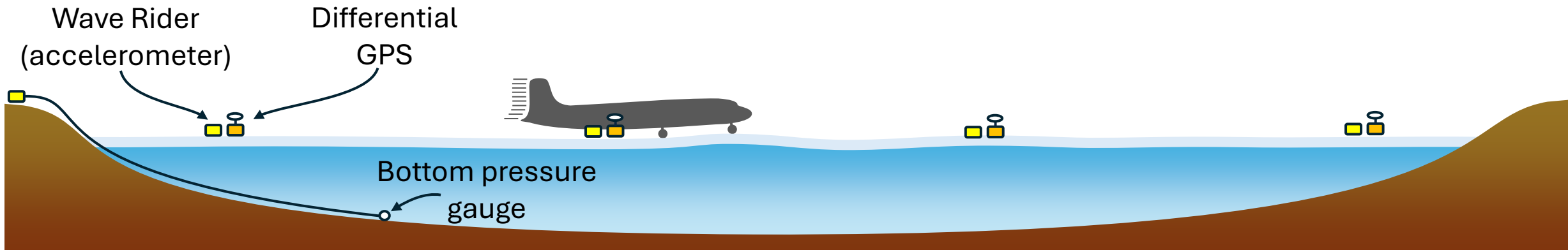
Experimental Approach

1. Deploy instruments to measure ice deflection

- On the ice: accelerometers, high-precision GPS
- Below the ice: water pressure transducers
- Through the ice: temperature strings

2. Multiple touch-and-go and full-stop landings and takeoffs

- Different aircraft at different speeds
- Repeat in **late March / early April** and **late April / early May**



Plowed runway surface

Plowed ice surface
~5500 x 100 ft

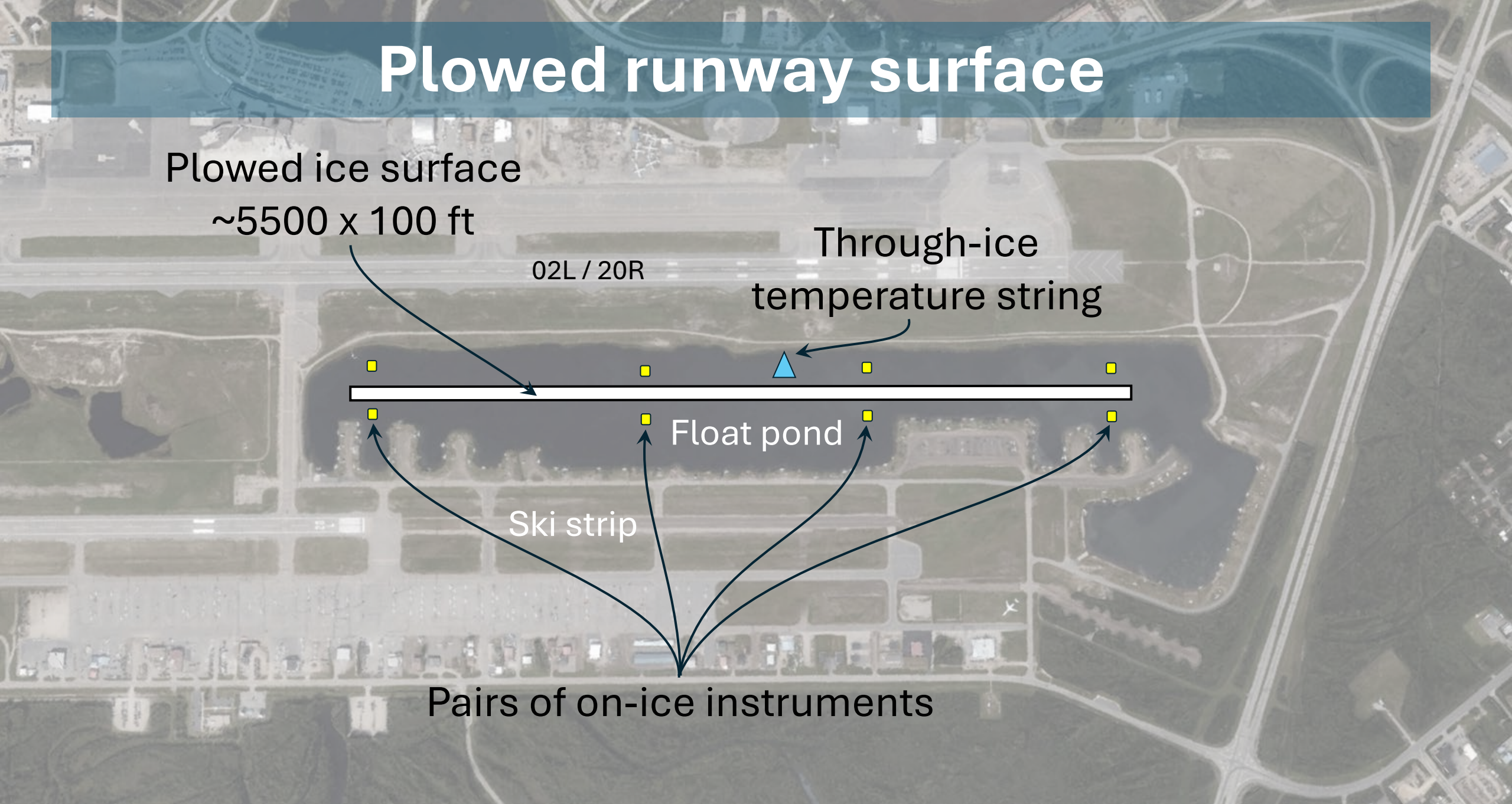
02L / 20R

Through-ice
temperature string

Float pond

Ski strip

Pairs of on-ice instruments



Tentative snow removal plan

5,500 x 100 ft plowed surface for landing DC-6

- *Approx. monthly during winter to encourage ice growth*
- *Final preparation prior to first landing experiment period*



The U.S. Navy Arctic Submarine Lab has agreed to loan a UTV and Bercomac snow thrower for this experiment



Questions

Who uses the float pond in winter?

How can we minimize interference?

- we don't have to remove the snow to bare ice

- we can leave some untouched snow on one side

What questions do you have for us?

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