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Mr. Bryan R. Pearson, President
Arctic Ventures, Ltd.
Yellowknife Inn
Yellowknife, Northwest Territories
Canada

Dear Mr. Pearson:

In response to your inquiry at the recent Churchill Arctic Corridor Conference, a brief study was conducted to assess the ability of a 747 to land on sea ice. The study concentrated principally upon what requirements the ice field would have to meet before it could be considered as a safe 747 landing site. The study concluded:

- 1) A minimum ice thickness of nine feet would be required to prevent breakthrough with some safety margin.
- 2) The runway and taxiway surfaces would have to be compacted, smoothed, and hardened to eliminate potential tire rutting and excessive take-off drag.
- 3) A special reinforced parking area would be needed to prevent static "creep" and subsequent breakthrough.
- 4) Site preparations must include thorough landing area survey, ice depth measurement, adequate runway marking, and touch and go testing before the site can be considered safe for 747 operation.

The required ice thickness was determined for an airplane landing weight of 630,000 pounds which corresponds to about a 250,000-pound payload.

Prior experience with military aircraft has demonstrated the need for a uniformly compact, smooth, and hardened runway prior to aircraft use to prevent serious rutting and excessive takeoff drag. This procedure would be particularly important with the 747 aircraft since there is no precedent for operating such a heavy aircraft and high tire loads on ice. Several light weight test landings and takeoffs would be needed before normal heavy weight operations could be conducted.

For parking situations, experience has shown that gradual "creep" can occur even at low stress levels, causing eventual breakthrough. A prepared parking area must be provided for loading, unloading, and for parking in case of a crippled aircraft. These areas can be built up by flooding with sea water with or without adding chipped ice or snow as filler and allowing to freeze. Periodic leveling is required.

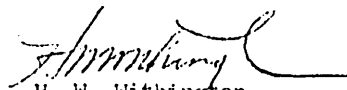
Other considerations that would have to be addressed in selecting and preparing an airfield are:

- a) Resonance waves develop in the ice and water as the airplane rolls. Characteristics of these waves depend upon airplane weight and speed, ice thickness, water depth and bottom gradient. To prevent these waves from shattering the ice, the runway and parking area should be located at least 1,200 feet off shore and the runway should be oriented at a 45° to 60° angle with the shoreline.
- b) Pockets of high salinity content or other impurities such as snow or slush stratification may cause local weak areas and should be identified and repaired.
- c) Runway length and width should allow for potential stability and control problems during ground handling (lengths on the order of 8,000 feet to 10,000 feet and widths of at least 300 feet).
- d) Prevailing winds should be considered in orienting the runway.
- e) Runway markings and landing aids should be adequate to permit pilots to easily judge heights and distances during approach and touchdown.
- f) Provisions for performing unscheduled maintenance should be considered where possible.

I hope that these preliminary comments answer your questions adequately.

Very truly yours,

BOEING COMMERCIAL AIRPLANE CO.
(A Division of The Boeing Company)



H. W. Withington
Vice President - Engineering