Incident Summary Report #II-663376-2018 (6244) Final

SUPPORTING INFORMATION	Incident Date		February 19, 2018
	Location		Whistler
	Regulated industry sector		Above-surface Ropeway
	Impact – Injury	Qty injuries	None
		Injury description	N/A
		Injury rating	None
	Impact – Damage	Damage description	Significant damage to the upper internal components of a main drive gearbox, that included: • Catastrophic failure of one of the two bevel wheel gear bearings. • The spinning of the outer race in the gear box case bore (housing) of the second bearing of the bevel wheel gear (causing the case bore to become oversized). Scoring damage to a beveled wheel gear and pinion gear.
		Damage rating	Moderate
	Incident rating		Moderate
	Incident overview		During the start-up and initial running of the ropeway on a signifantly cold day (-30°C) the main drive gearbox sustained significant damage to internal components. No passengers were on the lift line at the time.
INVESTIGATION CONCLUSIONS	Site, system and components		• Detachable chairlift. Overhead drive [i.e. Gearbox is mounted above drive sheave (bullwheel)]. • Main drive gear box consists of an upper horizontal input shaft running into a bevel pinion gear to a wheel gear which engages a vertically mounted 2 stage planetary gear assembly driving the bullwheel. • Oil flow is provided by an external oil pump. • Oil flow switches or transmitters had been installed with the purpose to cause alarm and/or shut down of the ropeway in the event of a low oil flow condition.
	Failure scenario(s)		Lack of lubrication due to poor oil flow because of cold temperatures lead to the failure of a set of upper bearings and gears of a main drive gearbox. Low oil flow sensors were inoperable or failed to detect the low oil flow condition.
	Facts and evidence		• Doppelmayr detachable chairlift • Lohman GPW 300 III main drive gearbox, No external or internal gearbox heater. • Two oil flow sensors where associated with this gearbox. One oil sensor that was provided by the manufacturer was inoperable (signal conductors not wired into system). A second oil flow sensor (Prosense FSA Series Flow Transmitter, model FSA1-42-27H) installed by the operator and utilized by a Supervisory Control and Data Acquisition System (SCADA) was operational. • Outside temperatures were reported to be approximately -30°C at the time of the incident • A low oil flow condition was not detected (no alarm, no shut down of ropeway)

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	• Gearbox lubricant: Chevron, RPM Universal Gear Lubricant, SAE 80W-90, Manufacturer's test data indicates the oil rates at a viscosity of 145 cSt at 40°C, Pour Point -33°C • Specifications for the second oil flow sensor (Prosense FSA Series Flow Transmitter, model FSA1-42-27H) indicate the maximum viscosity range of the fluid as 68 cSt, an operating temperature range of 0 to 60°C and a medium (fluid) temperature range of -10 to100°C.
Causes and contributing factors	• Cold temperatures and the resulting increase in the viscosity (pour point -33°C) of the lubricating oil prevented adequate oil flow to the upper components of the gearbox. The inadequate oil flow and the resulting lack of lubrication was the very likely cause of the damage to the upper components of the gearbox. • A likely contributing factor is that the manufacturers oil flow sensors were not functional and the second oil flow sensor's specifications were not within the parameters (temperature and viscosity) encountered at the time of the incident occurred and therefore failed to detect the low oil flow condition.

Photos or diagrams (if necessary)