

NAFLIC

National Association For Leisure Industry Certification

Standards & Related Documents Committee

TECHNICAL BULLETIN - MAY 2004

272. Gravitron Accidents

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There have been several recent incidents / accidents in the USA involving Gravitron rides. These were originally designed and manufactured by Wisdom Manufacturing Inc. but some were produced under licence, for the non-US market, by Vekoma of the Netherlands, A.R.M. (UK) Ltd and Ferrari, Australia. A Gravitron (also known as Starship 2000, etc.) carries 45 passengers in a fully enclosed rotor made up of segments each accommodating 3 people. The fundamental motion is purely rotation about a vertical axis.

One of the recent occurrences was another instance of a Gravitron failing to stop - a design fault that has been put right by modification on some Gravitrons. On this occasion the ride ran on for several minutes before it was stopped, and there was a similar incident on a different Gravitron in 2002 when there was a 20 minute overrun. This general design issue of control systems and subsystems having poor specification and / or inadequate safety integrity levels is quite a common one.

We are also reminded of frequent examples of various types of ride having emergency stops which remove power in a way which is unsatisfactory. Examples include removal of power without bringing the ride to a halt, and the switching off of lighting when the emergency stop button is pressed.

Much more important than the failures to stop, bearing in mind the consequences, was the recent Gravitron accident in Florida in which a complete rotor segment flew off, passengers and all. Seven people were injured, some seriously, including 3 ejected from the ride. This accident is said to have followed from failure of a bolt / pin. A similar accident, in Missouri, injured 11 people in 1991.

While we don't have any technical details, we have one or two observations which may or may not be related to what happened in Florida. Firstly, bearing in mind the type of motion and ride cycle, the loading is unlikely to induce fatigue in many ride components unless there is significant structural vibration. However, the region of the tyre-driven main ring could be an exception to this. Fretting and wear of pins and the holes in which they locate is a possible factor. Periodic replacement of pins is likely to be important on a device of this type.

Committee Members :- Dr Garry Fawcett MBE (Chairman), Mr Richard Barnes, Mr Peter Smith, Mr Ian Grant, Mr Steve Parker, Mr Eddie Price, Mr Mike Preston & Mr Dave Inman

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PO BOX 752, SUNDERLAND, SR3 1XX
TEL: (0191) 5239498 FAX: (0191) 5239498

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We believe that the internal steel framework of the panel segments is a fairly lightweight construction so the need for regular inspection for cracks and wear is likely to be an inspection requirement.

After the 1991 accident the U.S. Consumer Product Safety Commission based in Washington, D.C. called for changes. The modifications required ride controllers and / or inspectors to: "Install turntable safety plates, install corner pin reinforcement plates, install an inside strap to the bottom frame, note additions and changes to operators manual, check and replace floor pins (if necessary), inspect the panel bottom hole, for cracking, and trim carpet for easier floor pin inspection".

The nature of these required modifications, even though they are said to have been applied to the Florida Gravitron involved in the recent accident, may give some additional clues to what might have happened.

There is a recent (12 April 2004) Wisdom Industries Ltd Service Bulletin available for those that require it.