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**ACCEPTANCE**

**(PHASE 5)**

**FINAL TECHNICAL REPORT**

**by**

**A N Schofield and R S Steedman**

**1 January 1996**

**United States Army**

**EUROPEAN RESEARCH OFFICE OF THE U.S. ARMY**

**London England**

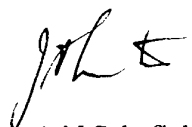
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## SUMMARY

This report is one of a series of reports by ANS&A Ltd prepared as a part of ANS&A's research under their response to the BAA of December 1988, addressing the completion of the manufacture and assembly stage of the Acutronic 684-1 centrifuge in France during the summer of 1995.

The completion of the centrifuge assembly and the Factory Acceptance procedures in France during 1995 was a critical period of intense activity during which ANS&A provided a close technical overview of the work of the Acutronic and TLM engineers. This was achieved through daily contact by ANS&A's Associate in France, and by regular visits from the UK.

During this period the delivery of all component parts and available documentation to Acutronic's subcontractor TLM in Franconville was completed, final machining was undertaken, the centrifuge was assembled and subassemblies were tested where practicable.

A second casting of the drive box was completed which did not show any internal defects on ultrasonic testing (surface defects were removed by machining). Other technical issues were relatively minor in nature; concerns were noted in relation to the mounting of the aerodynamic shrouds onto the platform, the tightness of fit of the counterweight geared screws and the manufacture of the instrumented spring supports. All of these were satisfactorily resolved.

Packing and transportation of the centrifuge from the TLM plant to the docks at Antwerp, where the centrifuge was loaded on board ship for onward transport to the USA, proceeded without incident.

**LIST OF KEYWORDS**

centrifuge  
research  
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## **1.0 INTRODUCTION**

### **1.1 CENTRIFUGE FABRICATION UPTO 1995**

This report is one of a series of reports prepared by Andrew N Schofield & Associates Ltd (ANS&A) addressing the development and commissioning of new capabilities for physical modeling research at the Waterways Experiment Station (WES), through the acquisition of a powerful centrifuge facility. The research described herein forms Phase 5 of the programme of work first proposed under ANS&A's response (of 17 April 1989) to the WES Broad Agency Announcement (BAA) of December 1988, and addresses the final assembly and factory acceptance of the Acutronic 684-1 centrifuge in France.

During the early stages of the centrifuge design and manufacture in France, ANS&A Associates monitored technical progress and participated in design review, raising areas of technical concern and advising WES on those aspects of the design which were considered to be particularly critical to future users.

Following the Final Design Review meeting on 18 and 19 November 1992 ANS&A continued to advise WES on the progress of manufacture of the centrifuge in France, making regular visits to the offices of Acutronic France and subcontractors in Paris and Rouen. All of these meetings were documented and are reported separately in the Final Technical Reports presenting the other phases of ANS&A's work.

Difficulties within the Acutronic group of companies led to delays in the fabrication of the Acutronic 684-1 centrifuge during 1994 and 1995 and in January 1995 Acutronic France SA was placed under the control of a legal trustee (administrateur judiciaire) by decision of the the commercial tribunal of Versailles in France. Manufacture of the centrifuge had been stopped since late 1994 but work recommenced in April 1995 under new contractual arrangements with the intention of completing the assembly, factory acceptance and delivery FOB of the centrifuge at Le Havre by July 21, 1995. This date was later extended to September 30, 1995.

### **1.2 OVERVIEW OF CENTRIFUGE COMPLETION**

The critical nature of the work in France during the final assembly and testing of the centrifuge required a closer overview by ANS&A than had been necessary to date with daily interaction with the Acutronic engineers on the quality of documentation, acceptance of components, centrifuge assembly, and arrangements for packing, loading and export. Mr Perdriat, formerly of Acutronic France SA, acted as an Associate of ANS&A during this period, working closely with the Acutronic and TLM engineers assigned to the WES centrifuge project. Regular visits to Acutronic's offices at Les Clayes sous Bois and to the subcontractor TLM, in Franconville, Paris, at whose factory the centrifuge was being assembled, were made also by Dr Steedman to discuss progress and inspect documentation. On delivery of the centrifuge by road from Paris to Antwerp, ANS&A also witnessed the transfer of the crates containing the centrifuge on board ship for carriage to the USA.

This report is the Final Technical Report detailing the findings of ANS&A's work in France during this period.

## **2.0 TECHNICAL ISSUES**

### **2.1 DRIVE BOX CASTING**

At the end of September 1994 machining of the drive box at TLM had revealed large pockets of cast residues in the casting in critical areas and it was concluded that this first casting was beyond repair. Devaux-Werts, the subcontractor responsible for the casting, proceeded to make a second cast (completed in 1995), which proved satisfactory under ultrasonic inspection despite some surface defects, which were removed by machining.

### **2.2 AERODYNAMIC SHROUDS**

The failure of the aerodynamic shrouds on a large Acutronic 685 installation in Japan, built to a similar design as the original WES centrifuge shrouds, during commissioning at 200 gravities led to a redesign and fabrication by the Acutronic subcontractor Courtaulds of a new pair of shrouds for the WES centrifuge. Although the 685 centrifuge platform was larger in dimension than the 684 platform the same design approach had been used for both shrouds and it was therefore considered that additional strengthening was required, particularly around the edge of the shroud where it locates against the hanging supports.

During the final assembly, these thickened members did not locate cleanly against the hanging straps and required modification. This was achieved by the Courtaulds engineers locally grinding away filling material glued around the main structural member on the rim of the carbon fibre shroud. In total around 5kg of material was removed from these locations and others, where this filling material was used for cosmetic purposes only.

### **2.3 COUNTERWEIGHT GEARED SCREWS**

Some of the geared screws on the counterweights were found to be excessively tight when assembled onto the tubular booms. This was resolved by increasing the assembly tolerances and remachining all of the screws accordingly. The finished screws were then reassembled onto the booms to confirm the ease of fit.

### **2.4 SUSPENSION SPRINGS**

The machining, surface treatment and fixing of strain gauges onto the suspension springs took longer than anticipated; to meet the delivery schedule an alternative approach was developed by the Acutronic team which reduced manufacturing time by more than two weeks but was considered to provide equivalent quality.

### **3.0 FACTORY ACCEPTANCE**

Factory acceptance of the WES centrifuge took place in two stages, with the first stage addressing the electrical systems and the second stage comprising a review of the large mechanical assemblies. The centrifuge was fully assembled on its transportation frame, with the exception of the platform, which was assembled separately but not suspended from the booms. This was not considered to be technically significant and would have caused further delay as it would have necessitated a particular sequence of mounting and demounting of the counterweights.

### **4.0 SHIPMENT**

ANS&A's role in the transport of the centrifuge was minimal, providing advice on the completion of the export documentation, transportation arrangements and witnessing the departure of the crates from TLM on 13 October 1995 and their loading on board ship at Antwerp, bound for New Orleans. No technical issues were raised during this period.

### **5.0 CONCLUSION**

The completion of the centrifuge assembly and Factory Acceptance procedures by the Acutronic engineers at the TLM plant in Paris during the summer of 1995 was a period of intense activity which was accomplished with the minimum of technical complications. Issues which arose which had a technical impact were discussed and resolved rapidly. Packaging and transport of the centrifuge from Paris to Antwerp, from where the centrifuge was shipped to the USA, took place without incident.