# Model Component Contract

**Submitted to:**

**Office of Naval Research**
**Ballston Tower One, 800 North Quincy Street**
**Arlington, VA 22217-5660**

**Dr. Paul Rispin, Program Manager**
**ONR Code 33X**
**703.696.0339**
**rispinp@onr.navy.mil**

**In fulfillment of the requirements for:**
**FY 2004 Cooperative Agreement No. N00014-04-2-0003**
***Agile Port and High Speed Ship Technologies***

***Project 7***
***Model Test and Evaluation of an Advanced Axial Flow Waterjet Pump Designed for the Coastal Commercial Ship Sealift Application***

**Classification: Unclassified**

**Prepared and submitted by:**

**Center for the Commercial Deployment of Transportation Technologies**
**California State University, Long Beach Foundation**
**6300 State University Drive, Suite 220 • Long Beach, CA 90815 • 562.985.7394**

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**STATUS REPORT**

**FY 04 PROJECT 7, PE 2.29**
**TASK NO. 7.3**

**CONTRACT AWARD FOR MODEL COMPONENTS**

**System:**

**Contract Award of the Model Components for the Water Tunnel Testing and Evaluation of an Advanced Axial-Flow Waterjet Pump Designed for** the Coastal Commercial Ship Sealift Application

By:


CDI Marine Company
Systems Development Division
900 Ritchie Highway
Severna Park, MD 21146


For:

Center for the Commercial Deployment of Transportation Technologies
6300 State University Drive, Suite 332
Long Beach, CA 90815


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**CCDoTT Project Director:**
Stanley Wheatley
CCDoTT
6300 State University Drive, Suite 332
Long Beach, CA 90815

**CDI Marine SDD Technical Manager:**
John Purnell
CDI Marine Systems Development Division
900 Ritchie Highway, Suite 102
Severna Park, MD 21146



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## FOREWORD

CDI Marine Systems Development Division (CDIM-SDD) prepared the work described in this working paper for the Center for the Commercial Deployment of Transportation Technologies (CCDoTT) at California State University, Long Beach. The principal point of contact at CDIM-SDD was Mr. John Purnell. The principal point of contact at CCDoTT was Mr. Stan Wheatley.

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## 1.0 INTRODUCTION

The water tunnel model testing of an advanced axial-flow waterjet pump will be performed using a 7.5-inch diameter impeller in the model assembly for the testing. The baseline design concept is a 90-inch diameter waterjet pump, giving a scale ratio for the model of 1:12 [(1)]. The pump model will be tested in the 24-inch water tunnel at the Carderock Division, Naval Surface Warfare Center (CDNSWC) in West Bethesda, Maryland. The pump model tests are necessary to characterize the performance and cavitation characteristics of the full-scale pump. An important element in the planned testing is the actual construction of the model components, which requires a manufacturer capable of proper attention to details and quality.

## 2.0 BACKGROUND

The testing of a 1/12th-scale model of an advanced axial-flow waterjet pump is planned. Over the years, CDI Marine Systems Development Division (CDIM-SDD) personnel have not only designed many propulsor and lift fans, but have gained experience in model testing of these turbomachinery type systems. Design and testing has included testing of fan, propeller, and pump systems that all have numerous similarities in their basic testing requirements [(1-4)]. Proper model testing requires proper construction of the model components, which requires special attention to details and quality machining.

NuCon Corporation is a machining company located in Lavonia, Michigan, specializing in precision 5-axis machining since 1973. CDIM-SDD has used NuCon to construct different models over the years, with two recent examples being:

- Construction of a model test pump and assembly components for a study done for the Gulf Coast Regional Maritime Technology Center, University of New Orleans (Reference 2).

- Construction of a 12-inch diameter, 13-bladed centrifugal fan impeller for performance model testing of a new high-pressure air cushion vehicle lift fan design (Reference 3).

NuCon has also constructed impellers and blading designed with CDIM-SDD personnel involvement for other customers. Notably, NuCon has built the present versions of the waterjet pumps that are in use for the USMC Expeditionary Fighting Vehicle (EFV) (formerly the Advanced Amphibious Assault Vehicle (AAAV)) prototype development program. NuCon also manufactured an earlier waterjet version that used inducer type impeller blading for that program which involved inputs of CDIM-SDD personnel.

## 3.0 CONTRACT DETAILS

There are nine different parts to be made plus the modification of 1 existing part. Figure 1 shows the basic rear drive model pump assembly with all parts to be made called out, except for one minor part noted below. The parts involved in the contract award and the quantities required are identified below using the circled part numbers illustrated on Figure 1:

Part # 3 — Nose Cone, to be made from black acetal (quantity 1)

Part # 4 — Rotor, to be NC machined from 6061-T6 aluminum, anodized 0.002" thick, dark gray color, per Mil-A-8625, Type 3, Class 2 (quantity 1)

Part # 5 — Stator, to be NC machined from 6061-T6 aluminum, anodized 0.002" thick, dark gray color, per Mil-A-8625, Type 3, Class 2 (quantity 1)

Part # 6 — Rear Drive Shroud, to be made from clear acrylic rod (quantity 1)

Part # 7 — Stator Securing Pins, to be made from 18-8 stainless steel (quantity 16)

Part # 8 Marion Mold Navajo Bearing, existing bearing part to be modified with chamfer (quantity 1)

Part # 9 Stator Adaptor, to be made from 6061-T6 aluminum (quantity 1)

Part # 11 Solid Shaft, to be made from 316 stainless steel (quantity 1)

Part # 25 Bearing Retainer Ring, to be made from 6061-T6 aluminum (quantity 1)

Part # 26 Locator Pins, to be made from 18-8 stainless steel (quantity 2, not shown in Figure 1, but are located at the interface between Parts # 6 & 9 to align and center their locations)

The manufacturer, as part of the contract, will supply the materials for all parts to be manufactured. As part of the contract, the stator (part # 5) will come assembled in the rear drive shroud (part # 6) using the stator pins (part # 7) as this will assure proper fit and assembly of these parts. The Marion Mold Navajo Bearing (part # 8) will be sent to the manufacturer for machining of a chamfer and to assure proper fit in the stator hub (part # 5). Part # 10 in Figure 1 is an existing 2-inch stub shaft that will be sent to the manufacturer to help assure proper fit and alignment of the manufactured parts associated with the overall assembly.

## 4.0 CONCLUSIONS

Based on previous good experience, quality and reliability, a contract to build the model test components was awarded to NuCon Corporation on 3 December 2004. NuCon has given a delivery date of 4 to 5 weeks after the receipt of the final drawing files and blade coordinate files. All final data and drawing files have been successfully received and reviewed by NuCon. The delivery of the model assembly should therefore be expected by the second half of January 2005.

## 5.0 REFERENCES

1. "Development of a High-Speed Sealift Waterjet Propulsion System", Final Report prepared for CCDoTT Program Element No. 2.20, Task Order No. 14, CDIM-SDD Report No. 748-9, September 2003.

2. Forstell, B.G. "Development of Design Technology for Integrated Waterjet Inlets, Nozzles, and Hullforms", CDIM-SDD Final Report for GCRMTC Research Project No. AMTC99-113, February 2003.

3. "HLCAC Model Lift Fan Test Report" CDIM-SDD Working Paper No. 755-7, January 2004.

4. "HLCAC Propulsor Model Test Report" CDIM-SDD Working Paper No. 755-10, February 2004.

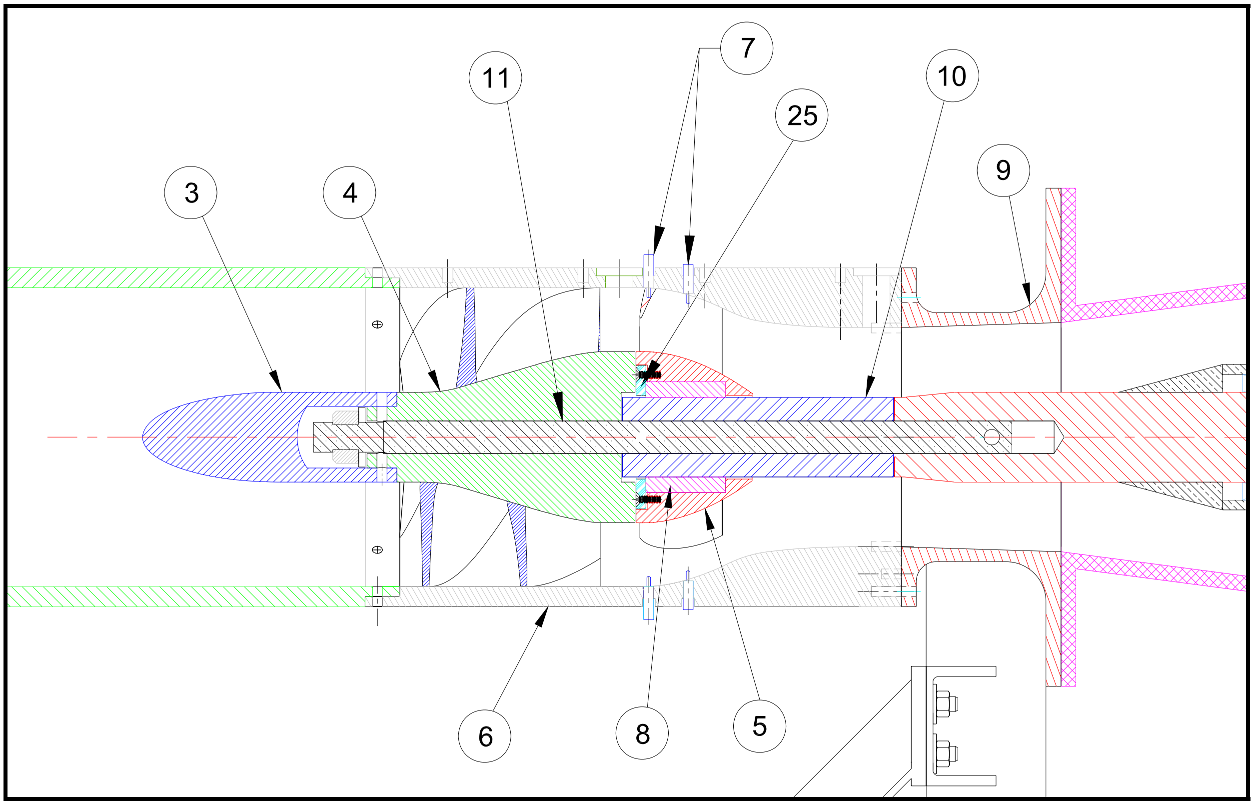


**Figure 1. Pump Model Assembly with Components Involved in the Contract Award**