During this period continued attention has been paid to task number 8 as cited in the proposed statement of work. While the water cooling and power feed to the heaters and the primary and secondary electrodes have been completed and are functional, vacuum leaks developed during testing of the system. A multitude of stress induced pinhole vacuum leaks which seriously delayed the final system assembly have been corrected. As a result, task No. 8 and the relevant changes in tasks numbered 3, 4, 5, and 6 have occupied more than 90% of the time.

Task No.1 Heat Pipe Construction:
Objective: Finalize the design, construct and test the five heat pipes required to provide the stable thermal environment for the crystal growth system.

Progress: All of the special BORALECTRIC heaters for the thermal levelers have had their final testing completed. The assembly and installation of the new heater power supplies has been completed. The performance requirements for the new heater power supplies have been confirmed. Thermal monitoring and feedback control will await further system testing.

Task No.2 Heat Pipe Heater and Heat Extraction System:
Objective: Provide the heaters and controls for maintaining the preset heat pipe temperature and controlled heat extraction.
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Progress: The new system has been installed. The initial testing has been successfully completed. Final performance will be evaluated as Task No. 8 nears completion.

Task No. 3 Optical Temperature Monitoring System
Objective: Integrate the several optical sensors for temperature monitoring with the optical sensing of the solid-melt growth interface.

Progress: The multiplexing network previously built for the germanium photodiode array is being used for testing the new units. Water cooling for the photodiodes has been completed and the system has been completely retested for vacuum leaks. Unfortunately, the commercial coax lines used inside the chamber for signal transmission failed the temperature test. The new high temperature coax lines will be completed and installed in the next quarter. They will be able to sustain ambient temperatures above 1300K.

Task No. 4 Replenishment Source Development:
Objective: Finalize the design, assemble and test the RF heater coil, coupling network and ancillary heater to provide the controlled replenishment of the melt.

Progress: The two kilowatt, 13.56 MHz, RF generator with its matching network has passed the preliminary tests. The overall configuration of the system requires a bottom-up construction. Precautions required to avoid extensive system damage during the early testing have been successful to date. New tests with the preheater in place, the chamber at or above atmospheric pressure and the thermal levelers operating, have been conducted. Power dissipation of the preheater may have to be modified in the final operating mode. Tests of the three element heater assembly below the melt zone were successful. The observation of the magnified image of the edge of the nucleating tip and the replenishment flow with the new optical system appears to be acceptable for visual or electronic monitoring. The drive mechanism for controlling the displacement of the replenishment source will be assembled and tested in the next quarter. The capacitance between the melt and an electrode placed above the melt will be monitored. As the melt level changes the changing capacitance will be used through a feedback loop to the replenishment RF power supply to control the melt.
thickness directly. The system is scheduled for testing in the next quarter.

**Task No. 5 RF Electrode Assembly:**
Objective: This task is to assemble the RF electrode ensemble to assure that the spacing, dielectric coupling, thermal and mechanical stability and correct geometrical properties are secured.

Progress: The properties of silicon nitride appear to be very favorable for the formation of the dielectric layer and also provide desirable features for other applications within the system. Silicon nitride for the dielectric layer has been deposited on six four inch wafers coated and are being prepared for electrode assembly. The performance of the coatings at temperature has been delayed. Final electrode assembly should be completed early in the third quarter of 1996.

**Task No. 6 Solid-Liquid Interface Monitors:**
Objective: Complete the development of the optical sensors required to sense the three principal solid-liquid interfaces: a) The sloping growth interface, b) the nucleating edge and c) the growth termination edge.

Progress: An optical system for magnifying and monitoring the edge of the sloping solid-liquid interface has been constructed. The analysis of an alternate system for monitoring the horizontal growth termination edge has been completed and the system has been constructed, including the appropriate power supplies. This system should also complement the current optical system for monitoring the horizontal nucleating edge. Testing of this new system is now scheduled for the third quarter of 1996.

**Task No. 7 Ribbon Seed Preparation (Proprietary)**
Objective: The Task is to acquire, clean and etch the crystal seed for the initial ribbon growth.

Progress: Some suitable three inch wafers have been made available for ribbon seed preparation. Apparatus designed for the prototype shaping of a three inch crystal wafer has been constructed and tested. Several additional samples have been prepared for testing. Analysis of the system has been completed and will be verified with the initial seed-melt stability tests. Construction of secondary electrode power supply and the associated feedthru has
been completed and incorporated into the system. However, the tests of the seed-melt stability has been further postponed by the multiplicity of stress induced pinhole vacuum leaks. The seed-melt stability tests are scheduled for the third quarter 1996.

**Task No. 8 Overall System Assembly**

**Objective:** The task includes the overall assembly and testing of the growth processor.

**Progress:** Stubborn vacuum leaks have persisted which has resulted in a several complete reworkings of the cooling system. All feedthru connections have been retested. Water cooled shielding has been returned to below the seed ribbon. The heat sinks have been retested and installation completed. The pinhole leaks have been repaired so that the placement of the several heaters, thermal levelers, primary electrodes and the crystal ribbon seed can be reestablished. Installation of the secondary electrode system is under way. New tests are scheduled for the third quarter of 1996 leading to the silicon melt stability tests. Some of the photodiodes and shielded Pt-Pt(10% Rh) thermocouples must be repositioned to continue the testing. The high temperature coax lines are being installed inside the chamber as they are completed. The installation of the upper heat shields awaits the assembly of the drive for the replenishment supply. Next quarter testing will continue to evaluate the performance of all the components of the system as they are being assembled.

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