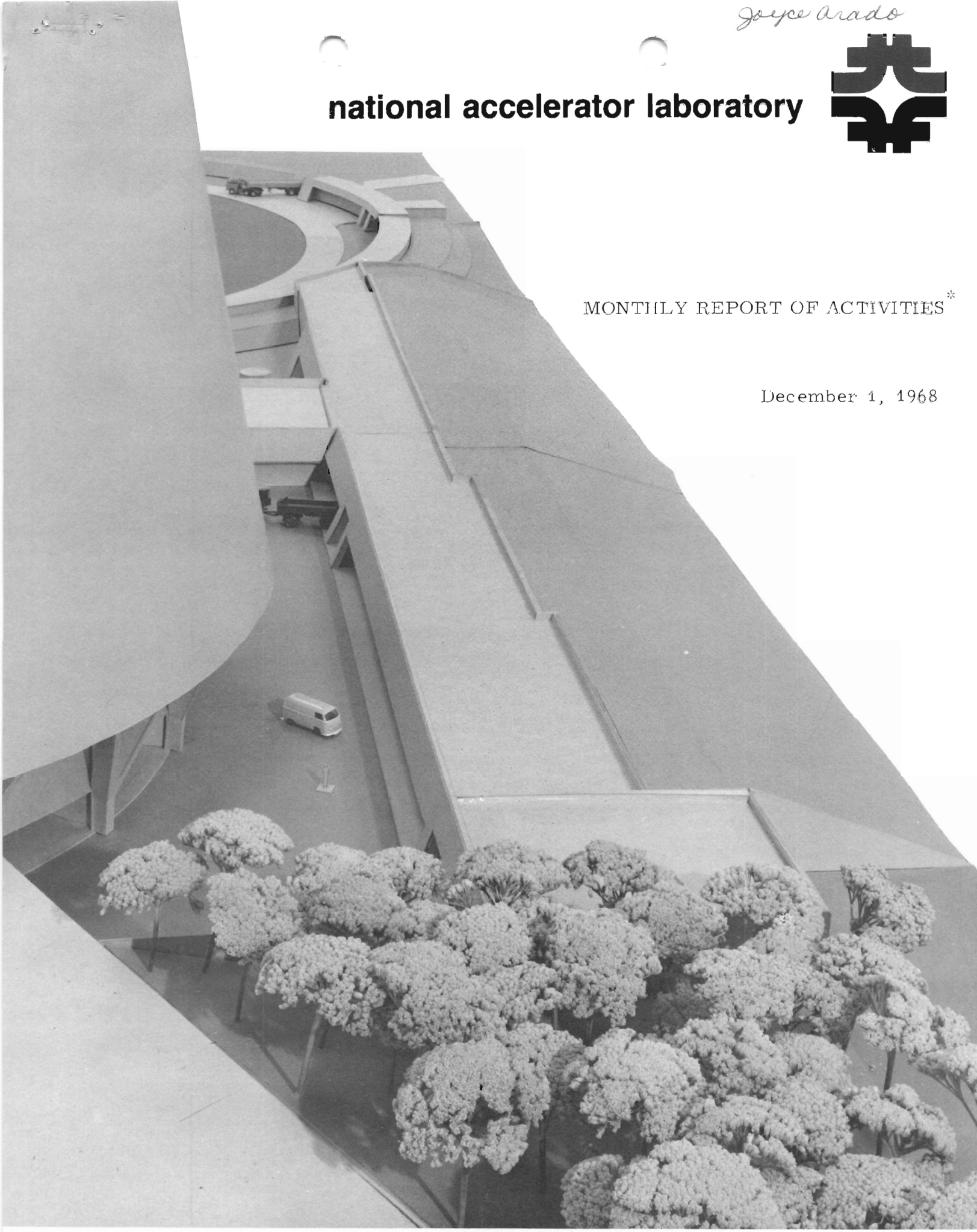
Joyce Arado

national accelerator laboratory



MONTHLY REPORT OF ACTIVITIES*

December 1, 1968

*This work was done under auspices of the United States Atomic Energy Commission.

national accelerator laboratory

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MONTHLY REPORT OF ACTIVITIES

F. T. Cole

December 1, 1968

Abstract: This report covers the activities of the National Accelerator Laboratory for the month of November.

General

1. Groundbreaking. This month's report coincides with the breaking of ground for the first permanent building of the National Accelerator Laboratory. To honor this event, the cover photograph shows a DUSAF model of this building, the Linac Enclosure. The view is roughly southwest, looking along the Linac, with the Booster Gallery in the distance and the Central Laboratory visible at the left.

2. Construction of Conventional Facilities.

a Linac Enclosure. A large number of bids was received and opened on November 13. The low bid was $1.818 million, slightly lower than both the latest DUSAF estimate and the original Design Report estimate. The large number of responses within a narrow range is a happy indicator to us. Notice to proceed was issued to the low bidder on November 22.

b. Rough Roads and Grading. Again, a large number of bids was received and opened on November 19. Several of the lower bids were approximately 6% less than the DUSAF estimate. The bids are now being evaluated; a contractor will be chosen when the land is available.

c. Booster Enclosure. Design Definition (Title I) was completed and submitted on November 27. It is still planned that Construction Design (Title II) will be completed and the package put out for bids by the end of December.

d. Laboratory Village Construction. Construction has begun on:

(i) the Main-Ring Enclosure Prototype, a 200-ft long section of the enclosure and a utility building;

(ii) the Booster-Enclosure Prototype, a 65-ft long section of the booster enclosure and gallery, and the temporary Booster Laboratory, a 10,000 sq ft prefabricated building for booster development and prototype work;

(iii) the temporary Main-Ring Laboratory, a 10,000 sq ft prefabricated building for main-ring work,

(iv) the Shop Building, a 10,000 sq ft prefabricated machine shop;

(v) the Beam-Transfer Laboratory, a 10,000 sq ft prefabricated building for the work of the Beam-Transfer Section.

The total estimated cost of these buildings was $404,000. The total of the contract prices is $392,000.

e. Changes in Village Plans. The Headquarters Quadrangle and AEM Buildings planned as temporary space in the Village have departed (with only controllable lamentation) from our plans. The purpose of the Quadrangle was to provide a central place for section leaders, in order to help communication between different parts of the Laboratory. We believe that we can accomplish this purpose in a shorter time and at lower cost by moving and modifying existing residences This work is now under way.

The purpose of the AEM Building was to house the DUSAF effort, which is now in rented quarters in Hinsdale. We still desire to bring the DUSAF effort to the site, in order to ease the burden of communication, and plan to modify existing farm buildings for this use. Again, we believe that this will provide working space in a shorter time and at lower cost.

3. Laboratory Staff. As of December 1, the Laboratory has 293 employees, including 76 scientists and engineers.

Theory

1. Storage Ring. A comprehensive design report has been prepared on the storage-ring studies carried out this summer and fall. It was discussed with the Laboratory's Physics Advisory Committee, as well as the Scientific Committee of the Board of Trustees of Universities Research Association and representatives of the High-Energy Physics Advisory Panel of the Atomic Energy Commission, on November 21 and is now being printed.

Linac

1. Prototype RF System. The 300-kW driver stages, which are amplifier stages driving the final 5-MW power amplifier of the rf system, are complete and are being used for power tests on a prototype drift-tube assembly. Tests have begun on the 10-MW modulated plate power supply at Continental Electronics in Dallas, Texas. The modulator has been pulsed for 250 microseconds at the rate of 15 pulses per second, operating at 34 kV into a 120-ohm load with no evidence of oscillations. The protective circuits have operated properly. Delivery of the modulator and 5-MW power amplifier is still expected in January, on schedule.

2. Quadrupoles and Drift Tubes. All parts for the first 18 drift tubes of the 10-MeV prototype have been fabricated and are being assembled, using electron-beam welding. The remaining 39 drift tubes are being fabricated, largely outside the Laboratory.

3. Beam Transport. Design of the beam-transport system from preaccelerator to linac has been completed and checked with the Brookhaven computer program. The Brookhaven program includes effects of quadrupole fringe fields and of space-charge forces. These latter effects are of great importance because of the high current (225 mA) for which the transport system must be designed.

Booster

1. Magnet Design. Measurements on the D1 and D2 dc magnet models and finite-permeability computational results have both shown that the good-field region is too small at high fields. Computer results also show that the

peak flux in the F magnets is higher than had been expected. The magnet cross section will be increased to overcome these effects.

2. Vacuum Model. The rough 3-ft vacuum model has been partially outgassed and has already reached a pressure of 10^{-5} torr. The 10-ft vacuum model has been stacked and enclosed in the vacuum chamber and potted.

3. Second-Harmonic Week. The study of the effects of adding a second harmonic to the booster rf waveform brought to light a number of theoretical problems. The most significant of these problems is that of space-charge effects at transition energy, when the beam is very tightly bunched. These effects can cause loss of beam. It seems clear that the space-charge effects are more severe at a cycling rate of 7.5 Hz than at 15 Hz, because of the higher beam current needed to produce the same average intensity and because of the lower accelerating voltage and consequent smaller rf focusing forces. This has cast some doubt on the proposals to provide initially for acceleration at 7.5 Hz in the booster. The problem is still being studied.

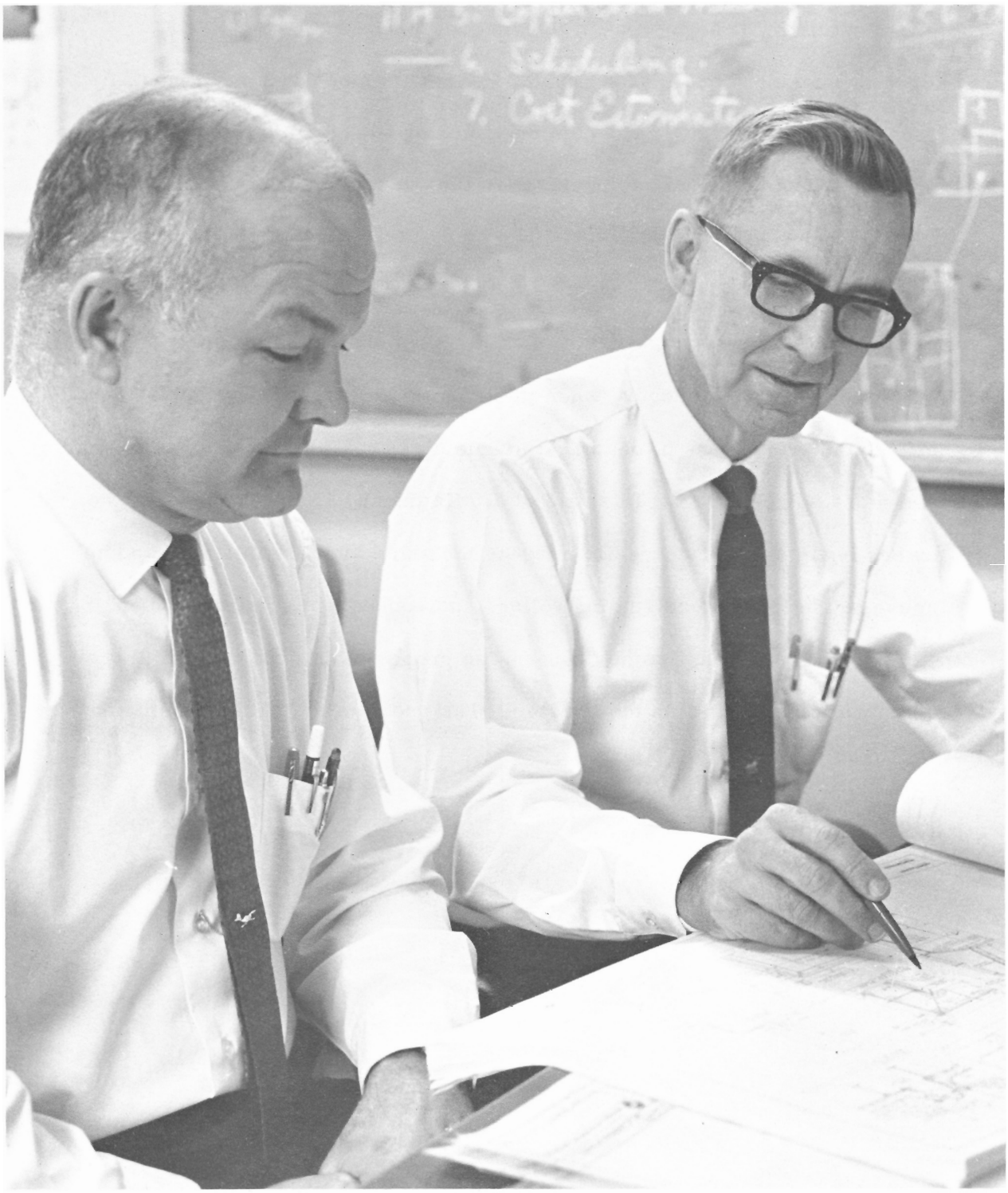

Fig. 1. Donald Young and Philip Livdahl of the Linac Section reviewing the design drawings for the Linac Enclosure.

Fig. 2. Site of the Groundbreaking, looking across the temporary parking lot toward the site of the Linac Enclosure.

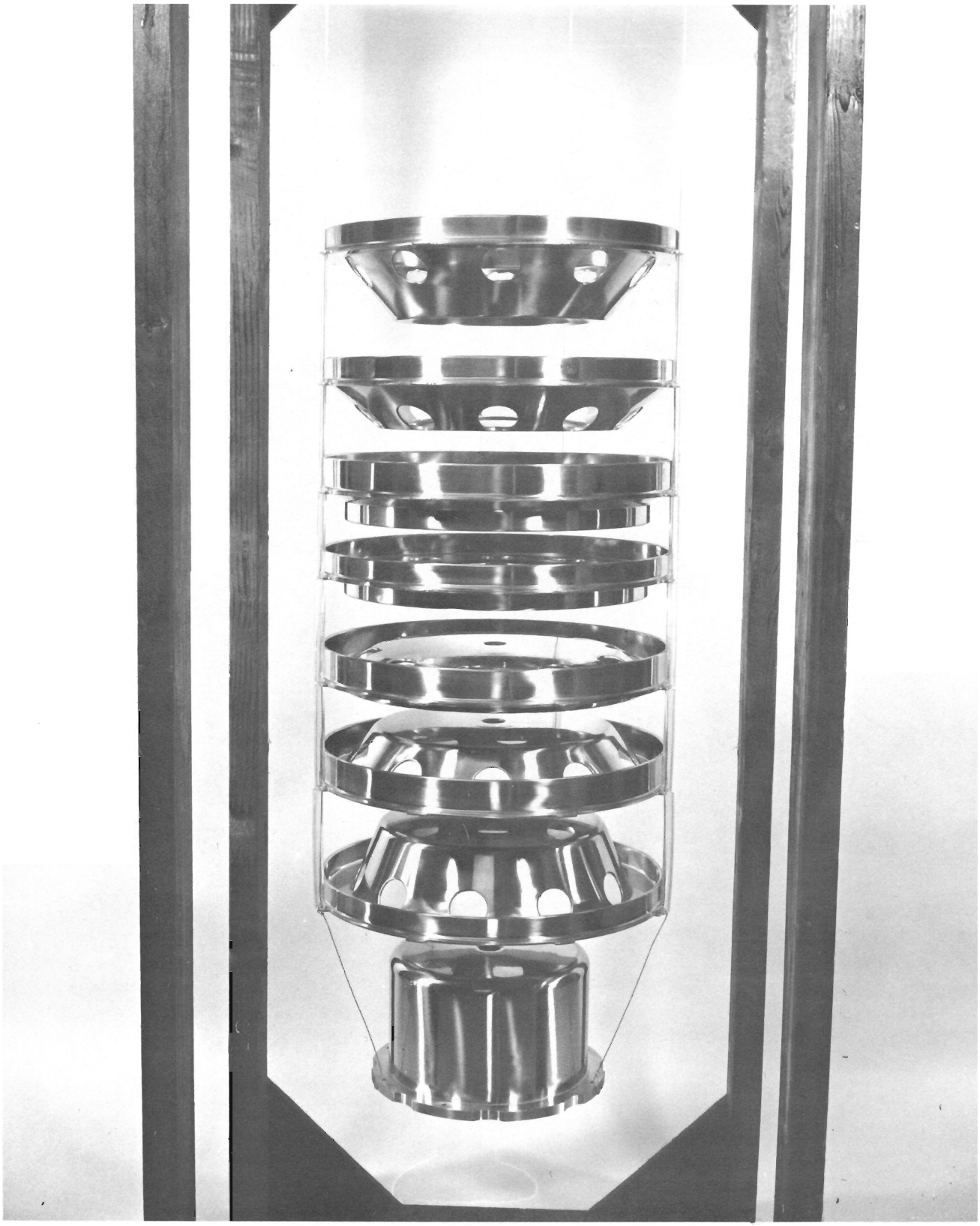

Fig. 3. Titanium electrodes of the accelerating column (at the fabricators).

Fig. 4. Beginning of construction of the Protomain.

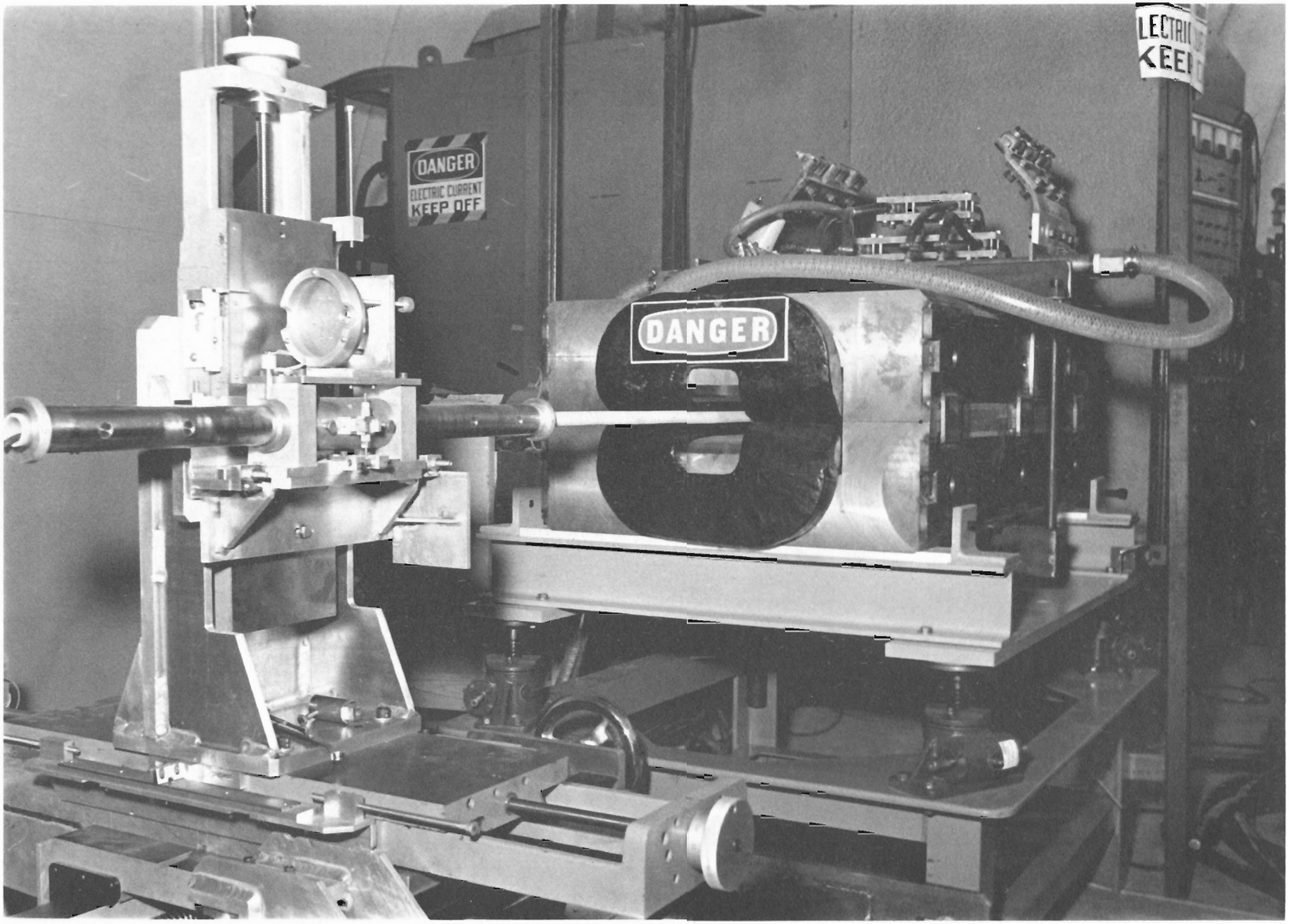

Fig. 5. The 3-foot Main-Ring B2 magnet model during measurement.

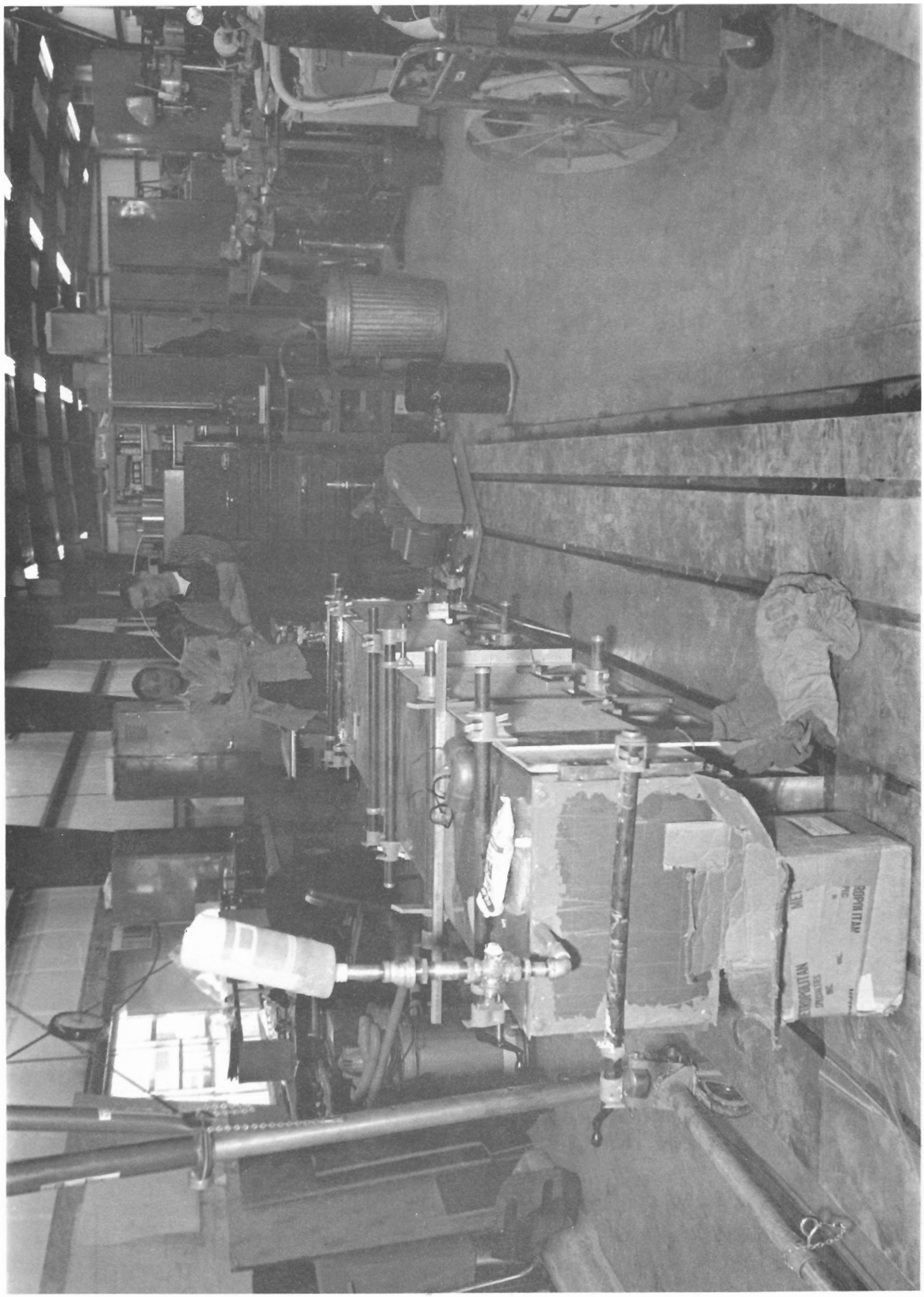

Fig. 6. The 10-foot Booster Vacuum Model during potting.

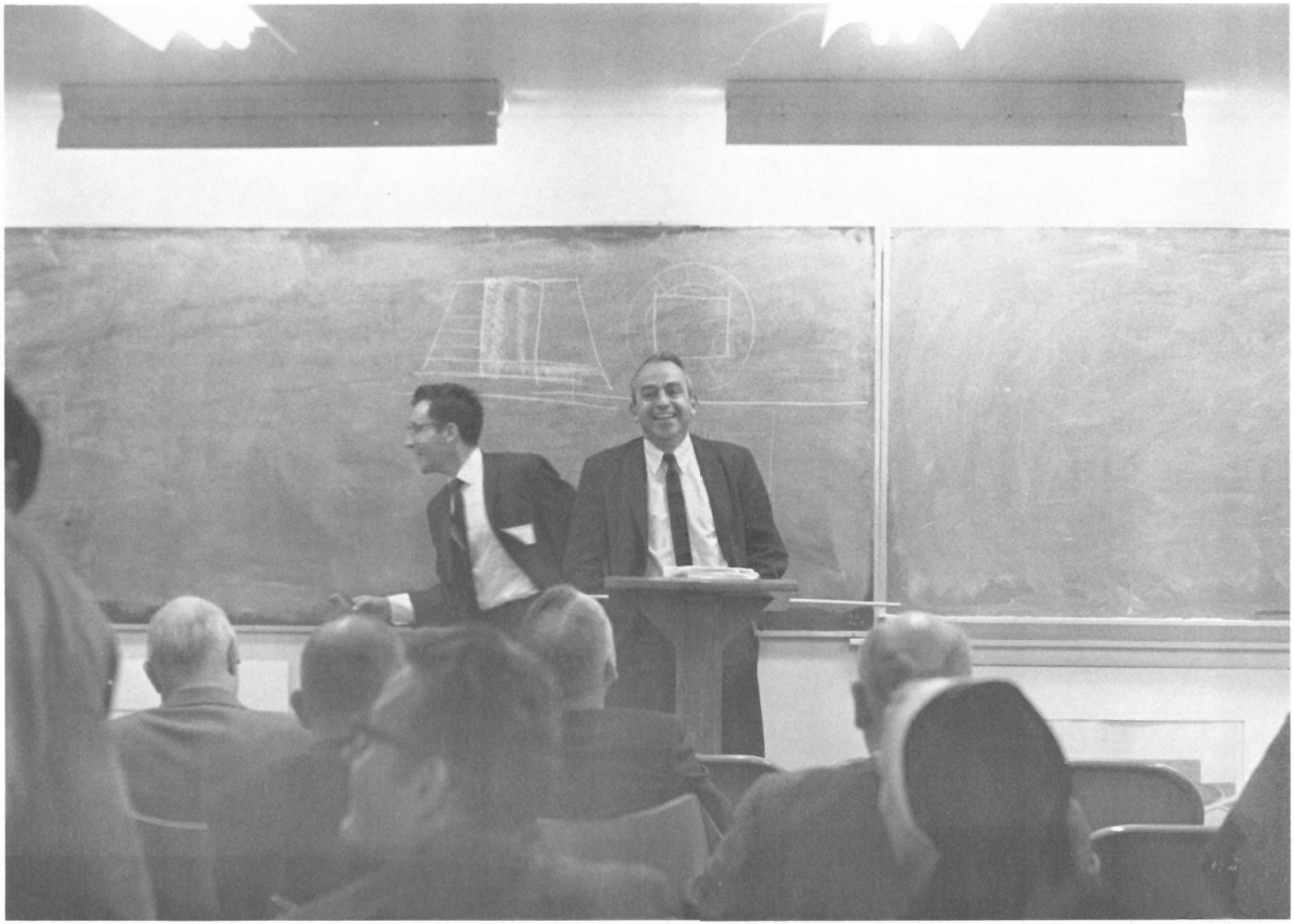

Fig. 7. Ned Goldwasser and Ernest Malamud during the Teachers' Workshop held November 16.

Fig. 8. The Cafeteria at lunch.