Dr W M Lomer
Building 329
AERE
Harwell

18 March 1975

Dear

Leo and I discussed the version of the note on the Scientific Programme of the Laser Laboratory that you let us have last week. I took a slightly modified version to Dr Stafford who suggested some drafting changes. I now enclose for your information a copy of the note in the form in which Dr Stafford submitted it to the SRC London Office. As you can see, the style has changed but the content and general emphasis does not differ too much from your version.

Yours sincerely

P R Williams

c.c. Dr L C W Hobbis
Dr C Whitehead

DRAFT

THE SCIENTIFIC PROGRAMME OF THE AEA/SRC JOINT LASER LABORATORY

Recent rapid advances in the technology of lasers have made light beams of unprecedented intensity available to experimental scientists. The scientific programme of the AEA/SRC joint laser laboratory is designed to investigate the behaviour of matter subjected to the extreme conditions produced by irradiation with this light. This basic scientific research will extend a field already being studied in several British universities. The programme has three main components.

i) The study of the interactions of the energetic light beams with normal density materials.

The high energy density of the light allows plasmas of very high temperature, ~100 million degrees centigrade, to be produced in the laboratory. The study of these high temperature plasmas complements and extends work currently in progress using magnetic confinement devices.

ii) The production and study of high density matter.

The ability has already been demonstrated in the USA to use highly focussed laser light beams to compress matter to densities and temperatures normally existing only in the interiors of stars. At the joint laser laboratory, this 'star like' matter will be produced and studied under controlled conditions. Preliminary experiments conducted in the USA have demonstrated that under suitable experimental conditions thermonuclear fusion reactions can occur; the detection of the resulting neutrons is an important means of determining the temperatures and densities reached. The provision of the laser laboratory facility will generate an experimental programme to complement the theoretical studies of laser induced compression to high densities that are already in progress in the UK.

iii) The study of laser physics and technology.

New high power lasers of improved efficiency, and generating light of different wavelengths, will be developed to allow greater diversity in the fields of study to be undertaken at the laboratory.

It may be possible that the use of lasers to initiate thermonuclear fusion offers a route to energy production alternative to that currently being followed using magnetic containment. Such a route is far from being proven and the programme of the joint laboratory itself is not directed towards this goal. The programme proposed is motivated by an interest in the new basic physical phenomena to be studied in the field of laser-matter interactions and constitutes a necessary research activity to be undertaken before realistic judgements of the ultimate feasibility of laser fusion power production can be made.

One benefit that will accrue from the scientific programme of the laser laboratory lies in the development of a cadre of scientists working in this new and rapidly expanding field. The existence of this group of scientists should enable the UK to take advantage as they occur of new developments in laser interaction physics and related studies.