UCID- 17297

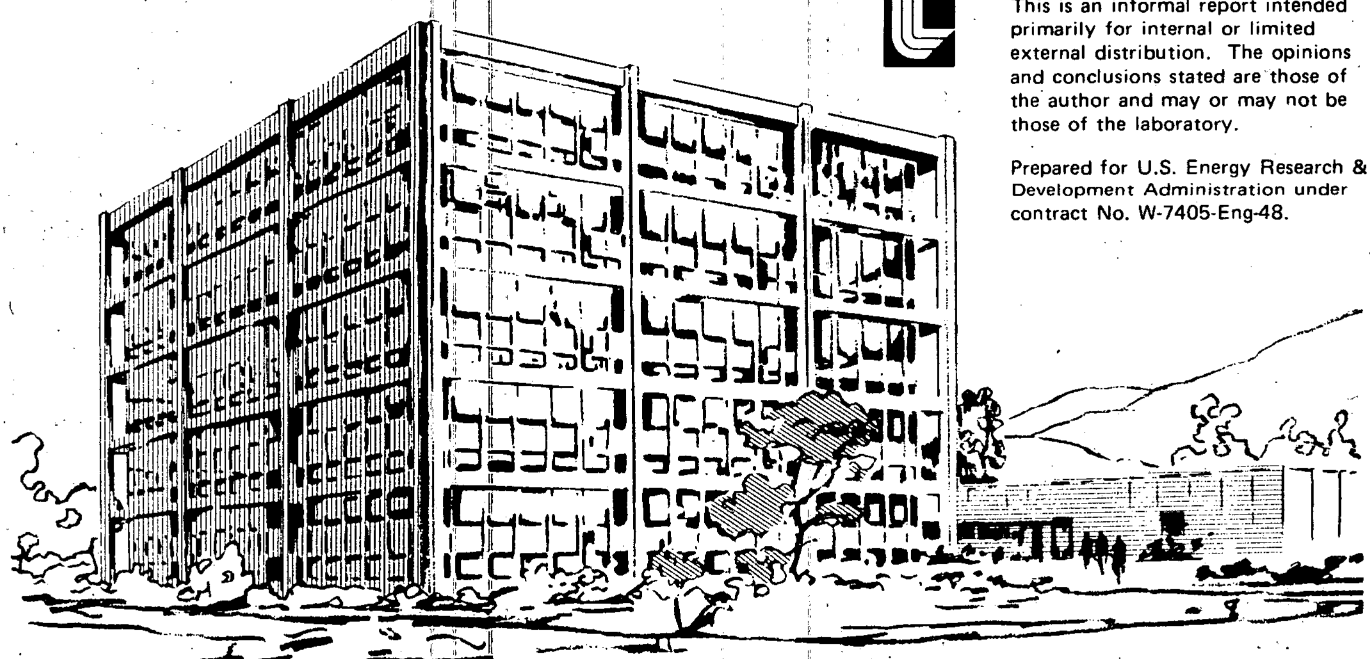
Lawrence Livermore Laboratory

A 1964 COMPUTER RUN ON A LASER-IMPLODED CAPSULE

Ray E. Kidder

March 28, 1973

MASTER



This is an informal report intended primarily for internal or limited external distribution. The opinions and conclusions stated are those of the author and may or may not be those of the laboratory.

Prepared for U.S. Energy Research & Development Administration under contract No. W-7405-Eng-48.

DISCLAIMER

A 1964 COMPUTER RUN ON A LASER-IMPLODED CAPSULE

Ray E. Kidder

The earliest computer run on a laser-imploded capsule, of which I have good records (I have the complete machine-dated computer printouts) is a run designated WAZER Alchemy 7b, dated July 2, 1964. As the name suggests, this problem was run on the WAZER computer code. This code originated as a modification of an earlier 3-temperature code.[1] An unclassified version of WAZER was published in the open literature four and a half years later.[2]

WAZER Alchemy 7b (WA-7b) is a WAZER calculation of a laser-driven micro-implosion of a spherical capsule consisting of a thin gold pusher surrounded by a thick (frozen) deuterium ablator. The properties of the target capsule and the shape of the laser pulse used to irradiate it are described in Appendix 1.

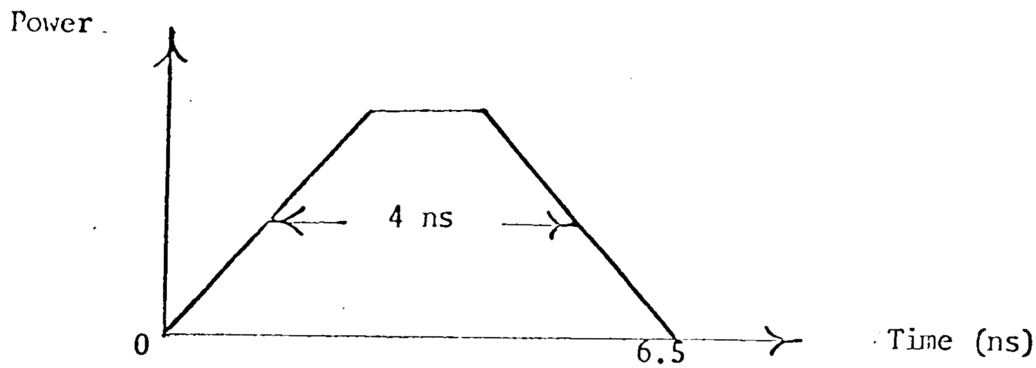
A spherically-convergent laser pulse with an energy of 500 kilojoules and a duration of 4 nanoseconds is focused on the capsule in vacuo. The laser light is absorbed (subsonically) in the outer portion of the deuterium ablator, heating it to a high temperature and driving a strong shock inward. This strong shock results from the violent blow-off of the laser-heated ablator in accordance with the rocket principle. The inward-moving shock then strikes the gold pusher, imparting to it an inward velocity of 200 kilometers per second, a sufficiently powerful implosion to ignite and burn efficiently the DT gas contained within it. (The dense-pusher implosion velocity criterion of 200 kilometers per second had been established earlier by calculations with configurations such as those considered in WAZER Alchemy 7b.)

Assuming a fuel burn-up of 65% (the imploded gold pusher improves the burn efficiency by actively tamping the highly compressed fuel) the thermonuclear energy yield of the Alchemy 7b capsule is 2.5 megajoules, five times the energy of the laser pulse used to implode the capsule. That is, an energy multiplication factor of 5 was predicted to be the result of irradiating this capsule with a non-tailored, 500 kilojoule, 4 nanosecond laser pulse.

REFERENCES

1. Q Division Progress Report, *Heating of Plasma by Intense Laser Light,* (title unclassified), Lawrence Livermore Laboratory internal SRD report COT 64-15 (April 1, 1964).
2. R. E. Kidder and W. S. Barnes, *WAZER, A One-Dimensional Two-Temperature Hydrodynamic Code*, Lawrence Livermore Laboratory report UCRL-50583 (January 31, 1969).

C. LASER PULSE SHAPE.



Laser Pulse Energy:	0.5 megajoules.
Laser Pulse Duration:	4 nanoseconds.
Peak Laser Power:	1.26×10^{14} watts.

Technical Information Department
LAWRENCE LIVERMORE LABORATORY
University of California | Livermore, California | 94550