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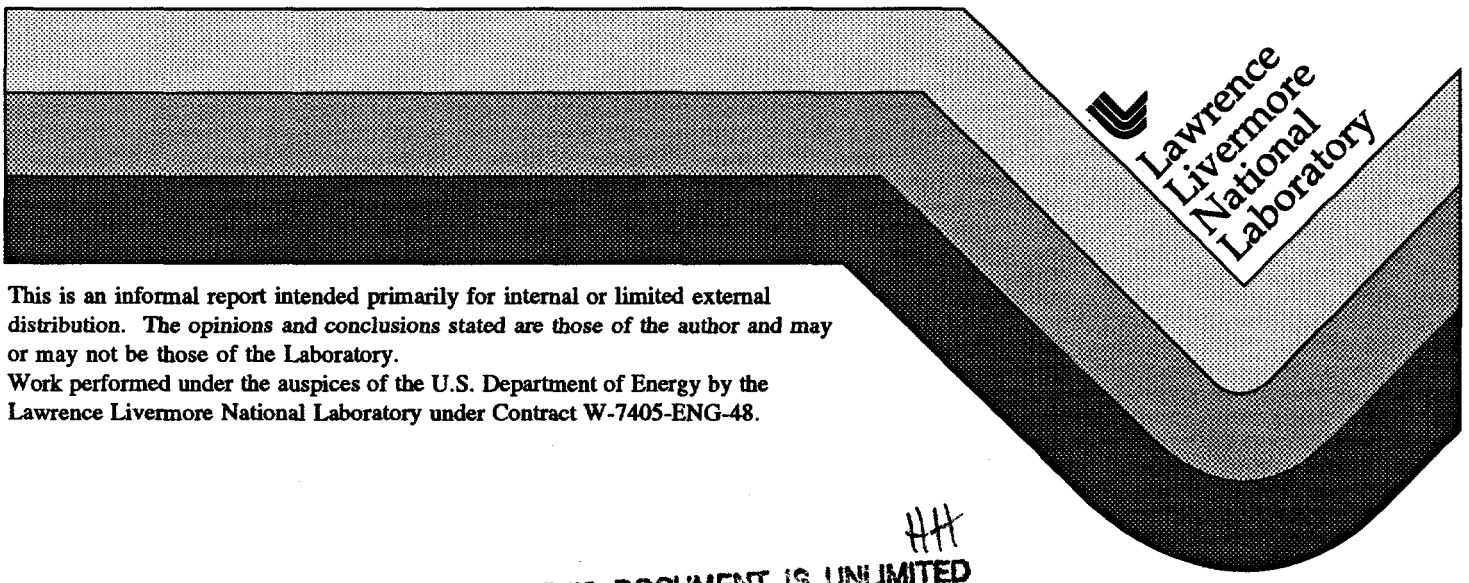
A Suggested Future Spade and Snoopy Program for Pluto Effort

E. Goldberg

July 13, 1961



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MEMORANDUM

July 13, 1961

TO: A. Kirschbaum

FROM: E. Goldberg

SUBJECT: A SUGGESTED FUTURE SPADE AND SNOOPY PROGRAM FOR PLUTO EFFORT

Dear Al:

According to your request, I would like to elaborate upon the topics discussed at the meeting this morning. These experiments that we desire are grouped into three sections. The first bears directly on Tory II-C.

1. Specific Tory II-C Features

a. Effect of front reflector on axial power profile.

It has been observed in experiments performed on Tory II-A-1 that the power density in the core close to the front reflector is 15% higher than that indicated by our Angie calculations. This effect is not understood. A Spade experiment involving a fission traverse would be appropriate.

b. Side support structure, duct, and shroud.

Experiments are currently in progress here on the Spade facilities.

c. Prototype control rod in Snoopy.

We will shortly have in our possession an actual Tory II-C control rod which we would like to investigate in a Snoopy assembly. This would involve rod bump and pulsed neutron techniques.

d. Control rod coupling studies.

These experiments are expected to be completed within the next month.

e. Reflection from external bodies.

This is meant to indicate the influence of such structures as the front support structure in Tory II-C upon core power density.

f. Additives.

At present it is thought that zirconia will be added to the fueled BeO for quality improvement. A Spade experiment involving a centrally located sheet of zirconium would be of value to us.

g. Emergency, unforseen problems.

[redacted]

2. Basic Studies

a. β_{eff}

This quantity would enable us to appreciate the experiments performed on the reactors themselves and correlate the findings more closely with results from our neutronic calculations. Presently our calculations on Tory II-A show a $K_{eff} = 1.04$ for the critical configuration. Basic information of the β_{eff} sort might enable us to reduce the magnitude of uncertainty in K_{eff}. To this end experiments involving pulsed neutron techniques should be performed on beryllium oxide and graphite systems. The role of delayed photoneutrons might be more completely understood from these findings.

b. ℓ^*

This quantity enters not only in the matter of the β_{eff}, but also is important in reactor control areas. In Tory II-A our calculated value for ℓ^* is 45 μs, whereas experiments involving the rod oscillator give approximately 70 μs. One would desire experimental values of higher accuracy to justify the comparison between calculation and experiment.

c. (Absorbed neutrons per fission) $\div$ dk/k for control rods.

This fraction is a great value to us in the determination of the hafnium control rod heating due to the (n,γ) process. We currently feel that $\Delta k = -0.13$ is required for the Tory II-C control. Therefore, each of the 12 rods should be $\Delta k - 0.011$. The intent here is one of adjusting the control rods for minimum required reactivity swing so as to keep the (n,γ) heat load on the rods to a minimum. Knowing, therefore, the reactivity worth required, the above fraction will then give us the number of absorbed neutrons. Further calculations utilizing Monte Carlo techniques yield heating values of the control rod. The above fraction has been evaluated through calculation. Experimental verification of these values would be of great value.

d. Resonance integral program; moving belt scheme.

This program is meant to serve several purposes. Data regarding control rod materials as well as structural materials would be desired. Evaluation of resonance integrals of reactor poisons and additives would be desired. Also basic studies would be encouraged. This program is clearly anticipated as quite extensive.

e. Thermal Snoopies.

Recently Hot Box experiments ranging up to a $C/U^{235} = 20{,}000$ have shown that the Zoom cross sections may be of poor quality in the lower energy groups. It would be of value to extend the Snoopy series to more thermal systems.

[redacted]

3. Miscellaneous

a. Tory II-A problems relating to test results

b. Checkout of detectors (e.g. Shwager's), techniques

c. Future reactor designs

d. Unanticipated experiments.

This essentially summarizes those points that I outlined this morning. If there are any questions that you might have, I'd be happy to elaborate upon these matters further.

Thank you.

Gene

E. Goldberg

EG:gn

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[redacted]