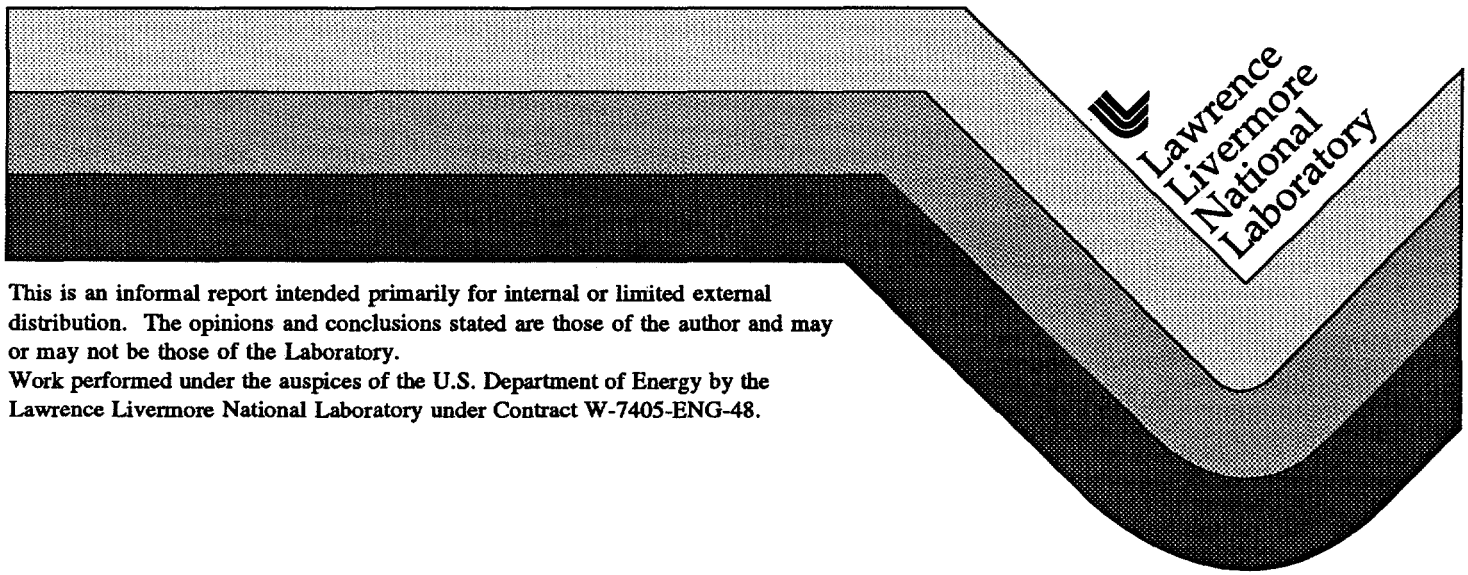
UCRL-ID-124989

Letter to J. S. Kelly, AEC on the Project Sulky Concept

G. W. Johnson

June 29, 1964



Work performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore National Laboratory under Contract W-7405-ENG-48.

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73/327

June 29, 1964

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DOCUMENT NUMBER 1033

Mr. John S. Kelly
Director, Division of Peaceful Nuclear Explosives
U. S. Atomic Energy Commission
Washington 25, D. C.

Ref: COPK 63-33, Project Sulky Concept dated October 31, 1963
COPKF 63-4, Analysis of Project Sulky dated December 27, 1963
COPKF 63-5, Synopsis of the [illegible] and [illegible] Estimates of the Distribution of radioactivity at long range from Sulky

Dear Mr. Kelly:

As you recall, the 100-ton nuclear cratering experiment in hardrock, Sulky, was deferred when we requested permission to execute it a few months ago. After review of the experimental plan, the nuclear excavation program, and the importance of nuclear excavation to the national objectives for an Isthmian canal, we are convinced the Sulky experiment should be executed as soon as practical.

There were several questions regarding the detectability of events from Sulky at the national borders. While experience from the Pike venting has been informative, no new definitive information has been obtained. However, it has been possible to modify the experimental plan to better document release of radioactivity from Sulky. We are convinced that Sulky will not be detected if it is fired under the wind conditions specified during the winter months; however, it is possible USSR will not concur in this conclusion.

Details of both the changes in experimental plan and Pike venting analysis are included.

We hereby request your approval to proceed with Project Sulky as originally requested with a readiness firing date of December 3, 1964. The radioactivity source measurements will be slightly modified to improve measurement precision and the wind sector for firing will be restricted so that the initial downwind direction will fall between 135 and 165 degrees.

Sincerely,

corrected by letter of this date to read wind sector 90-180 deg.

Gerald W. Johnson

GERALD W. JOHNSON
Associate Director for Plowshare

Encl: Appendix to Project Sulky Concept
An Evaluation of the Equivalent Fission Yield Vented from Pike

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Mr. John S. Kelly

June 29, 1964

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APPENDIX TO THE PROJECT

SULKY CONCEPT

I. INTRODUCTION

Since the preparation of the original concept letter additional experience with the detection and evaluation of the Pike vented fraction has improved our perspective on the problems of detectability at long-range and our confidence that most of the debris is deposited close in to the point of detonation.

The objectives of the experiment remain the same:

1. Experimental determination of the vented fraction.

   These data are particularly important to the normalization of the theoretical relationships which have been derived to relate depth of burial to the vented fraction for a given medium. A modification of the experimental plan will be made to permit added emphasis on the determination of the airborne source strength within a mile or two of ground zero. These data will make it possible to speak more specifically to the question of the percentage of the total radioactivity carried to long range by the wind and its probability of detection at long range.

   The USWB will be advised of this change in emphasis of the program, since it is particularly pertinent to the difference of opinion which exists between LRL and the USWB on the partition of the vented activity between that which readily falls out and that which reaches the ground only through convection and diffusion processes. The Pike results were insufficiently precise to shed any definitive information on the question. Several additional experiments will be required before the problem is well understood. An interpretation of the Pike data is included for reference.

2. Produce data on crater mechanics at a scaled depth greater than Dannyboy.

   High-explosive experiments by their very nature are restricted to yields that are small compared to what is readily accomplished with

with nuclear explosives. Further, the data will always be suspect because of (a) the uncertainties in the application of scaling relationships and (b) the differences in the nature of the explosions conducted with HE and NE.

3. Measurement of physical effects of the explosion at intermediate and long range.

It is always possible that effects other than those attributable to radioactivity may be the limiting feature of some specific Plowshare application. In order to reduce the probability of there being surprises associated with the physical effects on future applications of nuclear explosives it is important to continue the accumulation of data which define the limits and the magnitude of such effects.

II. COMPARISON WITH PIKE

Pike was not a cratering shot nor was it a planned vent; as a result any attempt at comparison of Pike and Sulky must be restricted to comparing the history of the vented radioactive debris.

1. The mechanism of release of radioactive material from these two shots is quite different. Pike is more comparable to the release of material through a long, small diameter pipe than to a venting of material through overburden as it moves upward and outward during the formation of a crater. There is likely to be a considerable difference in particle size distribution. The evidence is that the vented fraction from Pike contained a larger percentage of its activity on small particles than would be expected for Sulky. The result in such a case would be that Sulky would deposit a larger fraction of the vented activity closer to ground zero, or to put it another way, that a smaller fraction of the vented activity should be carried to long distances.

2. The vented fraction on Sulky is expected to be a factor of 5 to 10 smaller than for Pike. Further, Sulky would be shot only under meteorological conditions which would provide the maximum possible residence time for the airborne debris within the boundaries of the United States. This was not true for Pike. The winds at shot time

were northerly, with minimum velocity and directional shear, and of appreciable speed. These are precisely opposite to the conditions which have been established for conduct of the Sulky experiment.

A careful choice of wind structure, combined with Sulky's smaller vented fraction, should reduce the probability of detection at any border to insignificance; in part because of the dilution with distance, and in part because of the small percentage probability of reaching either Mexico or the Pacific Coast if shooting is restricted to the 135 to 165 degree sector (see data included in Table I, as extracted from the USWB publication, "A Climatology of 700 mb Trajectories Originating at the Nevada Test Site," dated March 1964).

TABLE I

TRAJECTORY EXIT PROBABILITIES, Dec. Through Feb.*

TRAJECTORY EXIT	PROBABILITY %	MEDIAN NUMBER OF DAYS
West Canada	50	2.4
East Canada	0	
Atlantic Ocean	50	4.0
Gulf of Mexico	0	
Mexico	0	
Pacific Ocean	0	

*For trajectories originating at NTS in the 135 to 165 degree sector.

III. COST AND TIME ESTIMATE

No changes are anticipated. The modifications to the experimental plan as outlined above are believed to be within the original estimates.