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PROJECT 6.4 b
APO 187, c/o PM
SAN FRANCISCO, CALIFORNIA

COMMANDER TASK GROUP 132.1
UNIT: CG, AFCRC
UNIT: MAJOR KEEGON
DATE: 14 Dec 52

SECURITY INFORMATION
November 1952

SAN 200087830000
DOCUMENT #

SUBJECT: Meteorological Aspects of MIKE Shot (Confidential)

THIS DOCUMENT CONSISTS OF 4 PAGE(S)

THRU: The Commanding General
Air Force Cambridge Research Center
250 Albany Street
Cambridge 30, Massachusetts

411348

1. In accordance with the instructions contained in various letters from your organization under the above mentioned reference and in a letter J-13457, dated at the Headquarters, Joint Task Force 132 on 7 August 1952, I have this day acted as an observer of the meteorological effects at Eniwetok Atoll of an explosion known as MIKE.
2. Since any possible value of this report to you lies in its reception at your headquarters with the minimum delay, I am writing it without the benefit of consultation with other advisers of Joint Task Force 132 and without access to data other than that taken by visual observation by Major O. W. Stopinski, USAF, and myself. Hence the observations and the conclusions derived from them are tentative, being subject to correction when more detailed instrumental and quantitative data become available to your laboratories.
3. The detonation occurred at 07.15 LST, 1 November 1952, as scheduled. It was observed from the flag bridge of the USS Estes AGC-12, at a distance of 31 miles on a line bearing approximately 155° from the shot island.
4. The weather near time of firing and at the point of observation is tabulated in Appendix 1 to this report.
5. The initial aspect of the explosion, seen through density goggles, consisted of an immense fireball which appeared on the horizon like the sun when half-risen; however, the angle subtended by the half-disc that its diameter at this time was between 3 and 4 miles. The fireball was not homogeneous but consisted of a bright inner core of approximately two thirds the total diameter surrounded by a thin, relatively dark shell (orange in color as seen through the goggles), the whole being enclosed in an outer, very bright shell which was the limiting region of the fireball.
6. The fireball seemed to ascend very rapidly after an initial hover time whose duration cannot be estimated, but which seemed to be shorter than those occurring with weapons tested last year.

DEPARTMENT OF ENERGY DECLASSIFICATION REVIEW	
FIRST REVIEW DATE: 09-12-97	DETERMINATION (CIRCLE NUMBER(S))
AUTHORITY: <input type="checkbox"/> AOC <input checked="" type="checkbox"/> ADC <input type="checkbox"/> ADD	1. CLASSIFICATION RETAINED
NAME: P. S. Jones	2. CLASSIFICATION CHANGED TO:
2ND REVIEW DATE: 10-22-97	3. CONTAINS NO DOE CLASSIFIED INFO
AUTHORITY: ADD	4. COORDINATE WITH:
NAME: R. Carpenter	5. CLASSIFICATION CANCELLED
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7. During its rapid initial ascent the ball contracted horizontally and became transformed into a fiery and exceedingly turbulent columnar cloud, losing its quasi-spherical form soon after the ascent began. I thought I saw a small secondary explosion in the fiery column at this time, but other observers do not confirm this. I removed the goggles immediately after this secondary detonation.

8. The "doughnut" or smoke ring was then formed, without much slackening in the rate of ascent. I estimate that the mushroom cloud reached the tropopause within $H/3$ minutes. Its vertical deceleration after 2 minutes was very rapid and was accompanied by a tremendous lateral spreading many times faster than that seen in A-bomb clouds. It appeared as if the cloud "splashed" against the tropopause.

9. The shock wave arrived at approximately $H/2$ minutes 28 seconds. Its intensity was not great, being estimated to be no greater than that from a 16 inch naval gun firing at 7 miles distance.

10. The stem passed into the head of the cloud and moved upward with it from the time the latter was first formed. At first the stem was relatively narrow, being not more than 1 mile in diameter and perfectly vertical; it seemed to be very turbulent but was not marked spirally as are some A-bomb stems. The turbulent appearance soon vanished and the stem expanded laterally to a diameter of 10 miles. At maximum and before deformation it presented a very smooth appearance like a pile of inverted saucers of different diameters, stacked one upon the other. The only natural cloud resembling the stem at this time is the vertically stacked altocumulus lenticularis seen over and near high mountains during foehn periods. I have seen clouds like the stem over the Sierras in California, and the Southern Alps in New Zealand and have seen photographs taken in Sardinia of similar structures associated with the Alps. There is no doubt in my mind that the smooth stem is a surround formed about the narrow turbulent initial stem by condensation in outside air taking part in the vortex-ring circulation. The smooth outlines indicate that this part of the circulation is non-turbulent streamline motion and that the various "saucers" are the result of variations in moisture content in the atmospheric layers partaking in the motion upward through the middle of the vortex ring. It may be assumed that the rapid lateral extension of the initial stem is an index of the rate of entrainment of outside air into the vortex ring system; if so, the rate must be many orders of magnitude greater than that in any previous detonation. At the point where the stem joined the head several large skirts formed toward the end of the ascent. Their presence suggested a highly saturated atmospheric layer at about 30,000 ft

11. In contrast to the broad stem the head remained turbulent. It still presented a cumuliform structure at $H/45$ minutes. By this time however, parts of it were being transformed into altocumulus and other parts (at the same level but on the opposite side of this cloud) into cirrus. After comparing notes with other observers, I am convinced that the mushroom cloud remained below the tropopause throughout the period of its expansion and thereafter. This is not to say that the entire cloud was limited by the tropopause but only the great bulk of it; consisting largely of condensation in entrained air, condensed steam from the sea surface and coral and other debris from the destroyed islands was so limited. There is indirect evidence that the initial central turbulent

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pillar pierced the tropopause at about H₃ minutes but its further ascent would be hidden by the great lateral development of the vortex ring (mushroom cloud). This expansion seemed to be symmetrical and very rapid in its initial stages but began to diminish sensibly by H₁₀ minutes. By H₁₅ minutes it had in all appearances ceased and the mushroom cloud at that time was 65 miles in diameter. In direct sunlight it was of a creamy white color but the shadows were intense orange. The first evidence of precipitation from the mushroom cloud occurred at H₁₆ minutes. Dark trails were seen descending from it in the vicinity of the stem. I suggest that these trails consisted largely of mud and rain. The first rainbow was seen below the top and to the left of the stem at H₁₇ minutes and rainbows were seen in various position under the cloud as the ship maneuvered between H₃₀ and H₄₅ minutes.

12. After H₁₅ minutes the intrinsic cloud motions having virtually ceased, the whole structure began to move and to be deformed by the winds near Eniwetok. Up to that time, however, it can be considered to be independent of the wind, the explosion having set up its own local symmetrical circulation over an area at least 65 miles in diameter. The mushroom cloud during the period of deformation was transformed into a dense sheet of altostratus topped by cirrus. Many cumulus shower clouds formed beneath it, penetrating it in places; rain also continued to fall from the altostratus but much of it was in the form of virga. The deterioration of the local weather prevented useful observation of the cloud after H₁ hour 30 minutes.

13. At sunset, the weather having improved considerably, opportunity again occurred of observing distant and high parts of the cloud. The sky color from 10 to 25 minutes after sunset were extra-ordinarily brilliant. Low in the west there appeared a chevron-shaped, brilliantly illuminated tenuous cloud which I suspect, since it was higher than natural cirrus in the vicinity, lay in the stratosphere. The tentative suggestion may be made that it was derived from a narrow filament that pierced the tropopause at H₃ minutes. Its position in the west suggests also that it moved with the stratospheric winds between 60,000 and 80,000 feet.

14. I have summarized the crude observations recorded here in the form of sketches (Appendix II). A comparison is also made with a conventional former explosion with the intention of emphasizing that from the geophysical point of view MIKE belongs to a different order of events from those previously studied in this region in Nevada.

/s/ C. E. PALMER
Professor of Geophysics
Institute of Geophysics
University of California

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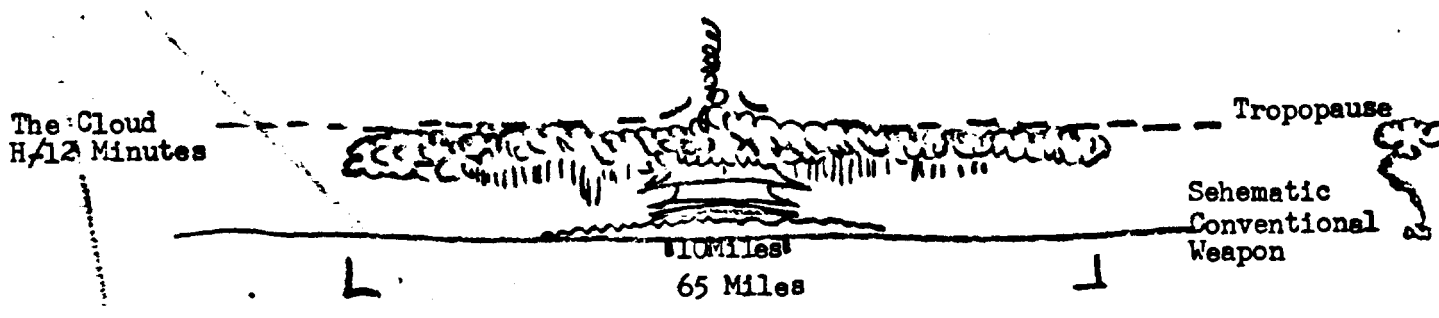
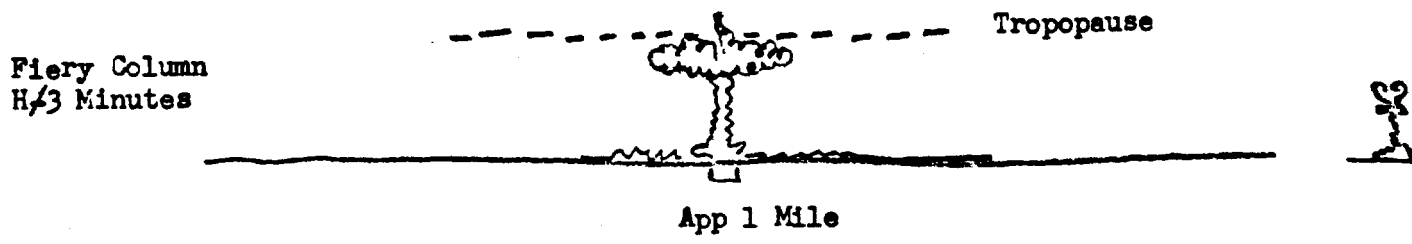
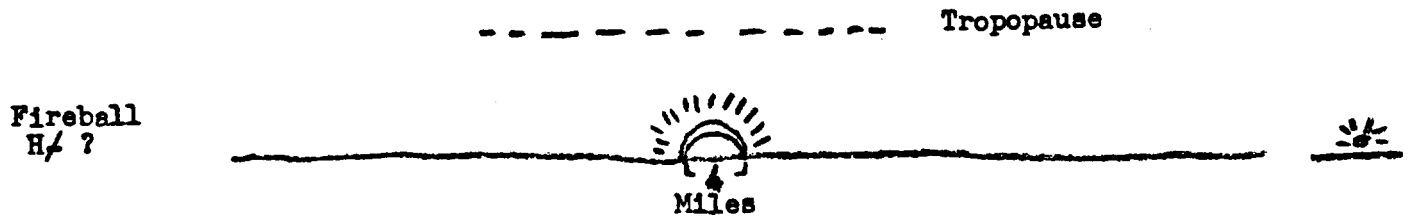
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APPENDIX II

MIKE

Standard
Conventional
Weapon



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