

CHAPTER VII

Meteorology and the Tests

Whenever any kind of explosion takes place, a very high temperature is produced in a very short time in a confined space. If a mass of air is heated, it expands and if it is heated very rapidly by an explosion, it expands very quickly. This rapid expansion causes a high pressure to be built up and the release of this high pressure is felt as a shock wave accompanying the explosion. The shock wave expands and produces considerable damage due to blast and is, of course, the reason why a thing which is exploded is often said to be "blown up".

In a tiny fraction of a second after an atomic bomb is exploded, the temperature produced is many million degrees Centigrade. The temperature of a really hot furnace is about 1000°C . so by comparison we see that the temperature which has been produced is fantastically high. This extremely hot source produces intense radiation and the first effect of this is a flash of light so intense that anyone looking at it would temporarily be blinded. A good deal of the radiation is absorbed by the air immediately around the explosion which becomes so hot that it is incandescent and forms the "fire-ball". The fire-ball increases rapidly in size, heating the air as it does so and, in addition, an intense shock wave is produced which gives the blast effects.

The meteorologists are not very interested in the blast effects, but they and the safety officers are vitally interested in the fire-ball and what it produces. It is well known that hot air rises, simply because the heat has caused it to expand and it becomes light and buoyant. At about 10 to 15 seconds after the explosion, the fire-ball will begin to rise, cooling, expanding and losing brilliancy as it does so, and carrying with it most of the products of the bomb. The intense heat of the explosion causes the material of which the bomb is made to be vaporized and later this vapour cools and condenses into small solid pieces of radio-active (R.A.) material. As the cloud forces its way upward, still expanding, it takes in air from the surrounding atmosphere and some of the cloud gets left behind. The whole thing then resembles a gigantic mushroom with a head (the cloud) and a stalk (the stem).

If the explosion has been high in the air, then the fire-ball will not touch the ground or sea and the only R.A. materials in the rising cloud are the tiny bits of the bomb. These are so small that they are carried to great heights and fall so slowly that they take weeks or even months to reach the earth. By that time their activity will have decayed and in any case they will be very diffuse and will not be dangerous.

From the point of view of fallout a burst high in the air differs greatly

from an explosion on the ground or at sea level. In such a case, where the fire-ball touches the earth or sea, tons of dirt or water will be drawn up into the cloud. This will become coated with R.A. material from the bomb and there will be a greater radioactive fallout. The various particles vary considerably in size, some are extremely small while others are as large as grains of sand or small water droplets. As the cloud rises, the smallest particles will be taken up with it but the largest ones will begin to "fall out" from the stem and the base of the cloud. A burst at ground or sea level will not be included in Operation "Grapple".

The first thing the meteorologist must do is to provide the safety officers with the data which they need to calculate how high the cloud will rise. The elements used in this calculation are the pressure, temperature and humidity in the upper air and the estimated power of the bomb. Measurements of upper air data can be made by aircraft: Shackletons for low and medium level and Canberras for high level flight. But to reach and investigate the really great heights in the atmosphere to be of value in the trials of atomic weapons, a meteorological balloon is used. This is filled with hydrogen until it is about 7 feet in diameter. It rises at about 1,200 feet per minute, swelling as it does so due to the fall off in atmospheric pressure with altitude, and finally it bursts at about 100,000 feet, by which time it is rather larger than the average four-bedroomed house. Attached to the balloon is a device known as a radio-sonde and this ingenious instrument measures temperature, pressure and humidity. The measuring elements are connected to a small radio set with a battery which transmits the value of each in turn. The signals are picked up by an ordinary M/F receiver on the ground and the results plotted out on a special form known as Te-phi gram.

When this form is completed the safety officers are then in a position to make their calculations for estimating the height to which the cloud will rise.

In Operation "Grapple" the Met. organization is as follows.

At Headquarters, Christmas Island there is the central Met. Office where radio-sonde ascents, wind finding to high altitudes, and surface observations are made. The principal task for which this office is responsible is the forecast of the special meteorological conditions for atomic trials, and also for general forecasts for the area and for flying. There is another shore station at Penrhyn Island which carries out radio-sonde ascents and wind finding and makes surface observations. All H.M. Ships taking part in the Operation will make observations as follows: H.M.S. *Narvik* is the permanent Met. station for the target area once she is fully equipped for radio-sonde ascents, wind-finding and surface observations as are the shore stations. No other ship is equipped for radio-sonde as it is not necessary to have too many sonde stations close together. H.M.S. *Warrior* is equipped for high altitude wind-finding and surface observations and is also equipped to carry out the functions of a H.Q. office afloat, corresponding to H.Q. Christmas Island. In addition two R.N.Z.N. frigates H.M.N.Z.S. *Rotoiti* and *Pukaki* have been specially equipped for high altitude wind-finding and surface observations. The apparatus used is the standard apparatus for shore stations, but this is the



Radio-sonde balloon being released from the target which can be seen in the background. The transmitter is being used to communicate with the ground station.

first operation in which H.M. Ship *Warrior* required to carry out observations of the target area. Reconnaissance aircraft will make observations at 45,000 feet making observations of cloud conditions measured by a very special instrument. Low level sorties, making similar observations to great heights, will be made. Data from other stations, H.M.S. *Narvik*, will be received by wireless. At H.Q. Christmas Island will also receive information from ships and shore stations will be used for their most important task.

As we ascend in the atmosphere from the ground, the temperature always falls off at an almost constant rate. The weather is much more complicated. Temperature increases and if it decreases very rapidly

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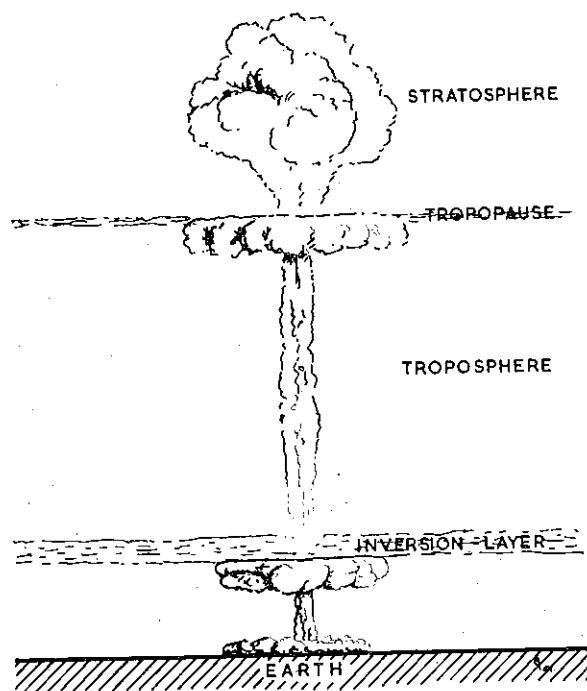
Radio-sonde balloon being released. Beneath the balloon
is the target which can be tracked by radar, while the
transmitter is being held in the hand

first operation in which H.M. Ships, particularly frigates, have been
required to carry out observations on so large a scale. Meteorological
reconnaissance aircraft will make both high and low level flights with
full observational reports. Canberra P.R.7 aircraft will fly at about
45,000 feet making observations of cloud, temperature and wind observa-
tions measured by a very special instrument. Shackleton aircraft make the
low level sorties, making similar observations. Ships and shore stations are
able to make observations to great heights, while aircraft are able to make
observations over a great area; daily sorties of about 2,000 miles will be
made. Data from other stations, Honolulu, Fiji Islands, etc., will be
received by wireless. At H.Q. will also be the safety officers and all informa-
tion from ships and shore stations will be received at H.Q. and passed to
them for their most important task.

As we ascend in the atmosphere from the earth's surface, the pressure
always falls off at an almost constant rate. Temperature variations are
much more complicated. Temperature usually decreases as height
increases and if it decreases very rapidly then rain clouds and radio-active

clouds can grow vertically through the atmosphere very quickly. Sometimes a layer forms in the lower atmosphere through which the temperature increases with height, and this tends to slow down the upward growth of any cloud, including the cloud from an atomic bomb. Such a layer is called an "inversion" and shallow inversions of variable nature are found in the lower layers of the atmosphere. However, if we go sufficiently high (35,000-40,000 feet in U.K., 50,000-55,000 feet at the Equator) we find an inversion which is permanent and sufficiently pronounced that no ordinary cloud can penetrate it. This inversion therefore forms an upper limit to our weather, rain clouds, thunderstorms and so on, and is called the "Tropopause". The layer beneath it, down to earth's surface, is called the "Troposphere". Above the tropopause is the "Stratosphere" in which the temperature is almost constant.

The mushroom cloud from a small atomic bomb would probably not reach the tropopause. The cloud from a medium size bomb would almost certainly reach the tropopause but would be unable to penetrate it, and thus would spread out beneath the tropopause like the head of a very flat mushroom. With a really large bomb, the cloud would penetrate the tropopause and ascend into the stratosphere, finally coming to rest at some great height, about 100,000 feet. It would probably look like the figure below:



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The only useful literature and a limited quantity Force has had to be produced by for a year it was decided been added to by pro certain offices, in add

There are two camps and the port camp has canteen, kitchens, and coolers. A limited amount but most of the show. It is not as salty as the and distillation is done

NAAFI amenities camp. There are indeed nice cold beer or squares of the beach and list was specially canned. Grapple, Christmas operate a gift shop and

In each camp there is a tion in an open-air theatre every night. As you

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STRATOSPHERE

TROPOPAUSE

TROPOSPHERE

INVERSION LAYER

CHAPTER VIII

Life on a Desert Island

To end up our booklet let's turn away from the serious aspect of the job in hand and say something about the sort of life led on Christmas Island out of working hours. The island may not be your complete idea of a tropical paradise—there are certain things missing!—but nevertheless a great deal has been done to ease the lot of those out there and to provide some relaxation. The remarks below cover all that has been accomplished in this respect up to the time of writing (November).

The only useful items available on Christmas Island are coral, coconuts and a limited quantity of fresh water. Everything for the use of the Task Force has had to be brought some 10,000 miles from the U.K. and water had to be produced by distillation. As the Force is only to be on the island for a year it was decided to put up a temporary tented camp, but this has been added to by providing buildings for kitchens, canteens, messes and certain offices, in addition to the normal camp structures.

There are two camps: the main camp near the airfield housing 2,000, and the port camp holding 250. Both camps have electric light and the canteen, kitchens, and messes are provided with refrigerators and bottle coolers. A limited amount of fresh water is available for washing purposes, but most of the showers use salt water from water-holes on the island. It is not as salty as the sea and ordinary soap will lather in it. All cooking and distillation is done with diesel oil.

NAAFI amenities are very good in both the port camp and the main camp. There are indoor games in the games rooms and one can drink a nice cold beer or squash in the beer garden pleasantly situated on the edge of the beach and listen to the pounding of the surf. Incidentally, the beer was specially canned for the Operation, the lids being stamped "Operation Grapple, Christmas Island" with the "Grapple" insignia. NAAFI also operate a gift shop and mails service order.

In each camp there is a cinema operated by the Army Kinema Corporation in an open-air theatre where a new programme can be seen almost every night. As you can imagine this is always well supported.

At first it was difficult to find time to play games, as working hours were long and the days very tiring. But as the pressure of work eased, so more enthusiasm and energy have been shown. All the games pitches have had to be constructed whilst the Force has been on the island. Fortunately lagoon mud, a well-graded fine coral, has proved to be a most suitable surface on which to play soccer, hockey or cricket. These pitches were easy to construct. A dried-out lagoon near the main camp was stripped of the light scrub from the surface of the "mud" and then the under layers

compacted. In this way pitches were brought into use in as little as four or five days. The laying of lagoon mud on hard coral was tried but it was found to be unsuitable as it soon dried out and then very quickly crumbled and became dust. Inter-unit matches have been played in all the major sports and the various leagues have proved to be very successful. A number of minor sports, such as basket-ball, deck-tennis and boxing, have also been patronized. Incidentally, the local natives have proved to be very keen cricketers and there have been some excellent matches with them.

An impression of an island in the Pacific is of soft, sandy beaches with surf in playful mood giving fun to all who enjoy swimming for their recreation. Unfortunately this is not the case on Christmas Island where dangerous current-swept reefs and numerous sharks and sting-ray fish limit the swimming facilities and make precautions necessary. Nets have been laid at suitable spots to prevent the entry of "toothy" monsters and safety ropes slung to enclose swimmers in a safe area. There is a further enclosure in shallow water for non-swimmers. Expert and medalled life-savers man the banks of the pool each Sunday afternoon to keep an eye on the less skilful or the too enthusiastic swimmer, and a luxurious raft enables the diver to practise his art—if the more playful swimmers allow him to. NAAFI are encouraged to open up shop "on the site" each Sunday afternoon and with the help of beach umbrellas create a "Lido"-like atmosphere not to be compared with Waikiki Beach, Honolulu!

A small, well-equipped rest centre has been established in St. Stanislas Bay on the south-east side of the island. The rest centre caters for 20 O.R.'s each weekend and provides a pleasant change from work and from camp conditions. One can swim, fish, play games or just relax in the cool, pleasantly furnished lounge.

The Misses Billie and Mary Burgess of the Women's Voluntary Services have brought a touch of home to the camp. They are to be found in the main camp NAAFI organizing games, dancing, Highland dancing and concerts, and generally helping to make off-duty hours in the recreation room pleasant and free from boredom.

Christmas Island in many ways is a photographer's paradise. Bright sun, vivid colours and exotic scenery combine to provide photographs normally found only in those beautiful glossy magazine articles about romantic desert isles. Such vivid colouring tempts many to take up colour photography, for it is quick and easy to send the negatives to England for processing. The more traditional black-and-white photographers are able to process their own films at the Photography Club, and some very fine prints have been obtained. The construction work affords an opportunity for interesting action shots, but even more successful are pictures of the island scenery—the graceful palm trees against delicate cloud patterns, crabs scuttling through the scrub, Gilbertese fishing by the lagoon. Even with the simplest equipment it is possible to make a record which will afford pleasure in later times, and to those who were not fortunate enough to be there it will give some pictorial idea of life on the island.

A news team of the Royal Army Educational Corps produces a daily newspaper called the *Mid-Pacific News*, for everybody on the island. It is the normal type of paper produced by the Corps for the Forces when it is



Father Christmas distributing to
(left) Peter Pumfret, aged 1 year and
(right), with Nurse Flannery