Sanitary Precautions on International Airways*

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THE STANDARDIZATION of sanitary measures and the supervision of the supply of food and water over the widely scattered system of air routes covered by Pan American Airways has presented a number of problems for the solution of which there is no precedent. In air transport a greater variation of climatic conditions is encountered than in any other form of transportation in the world. In less than an hour we fly from sea level to upwards of 10,000 feet, from the steaming heat of the tropics to extreme cold with a temperature change from more than 100° Fahrenheit to less than freezing. That section of the Pan American Airways System with which this paper deals is based at Miami and known as the Eastern Division. The routes of the Eastern Division extend from Miami to Buenos Aires, including British, Dutch and French Guianas, Brazil, the Argentine, Uruguay and Paraguay and also cover the Caribbean areas, touching Cuba, Jamaica, Panama, Colombia, Venezuela, Trinidad, the Leeward Islands, including Guadeloupe and Martinique, Puerto Rico and the Haitian and Dominican Republics—in all 22 countries with different customs, laws and varying degrees of progress in sanitation. The number of passengers carried in the Eastern Division in 1937 was about 70,000 and the number of passenger miles flown nearly 3,000,000. The supervision of the comfort and safety of such a large number of air passengers in port and in the air is a new field. The limited weight and space aboard aircraft and the rapidity with which they move are further complications, while the problem is made no easier by the fact that most of these countries lie in the tropics where sanitation has always been difficult.

In the early days of air transport the problem was to find planes that would fly and pilots with the knowledge and ability to fly them from point to point, and conform reasonably closely to schedule. The next step was to improve the planes, train pilots, systematize maintenance, develop safety measures—to touch on only a few of the major problems. All through this period other considerations had to be subordinated to completing schedules on time.

However, the problem of safeguarding passengers and crews was not wholly overlooked. Airport Managers were required to obtain water for planes from safe sources, to furnish the best and most sanitary food they could find, but at best it was on a hit-or-miss basis.

Eventually, it was felt that the time had come when methods and means of sanitation should be systematized and standard procedure set up. The organization had grown and

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been perfected to a point where other problems besides the technical ones of flying could be tackled. Close study could be given to measures to insure passengers' and crews' health and comfort, and our major difficulty was to overcome local pride and prejudice as, naturally, each country felt their sources of supply were beyond reproach.

As a start we had to analyze the problem and see what we had to solve. As a first step in order to survey all sources of water and ice, we requested airport managers and agents to send by plane to Miami in sterilized bottles to arrive not more than 72 hours after collection, samples of drinking water and the water melted from the ice used at their stations. Careful directions for sterilization and collection were given but this method was only partly successful. We obtained a few good samples which were analyzed by the Florida State Board of Health, but the chief value of this effort lay not in the results of the analysis but in the experience gained. We learned that better methods of water sample collection would have to be developed and that we would need information as to the sources of water and ice. While analysis of samples from each station would show whether the given sample of water was contaminated or safe, yet, if contaminated it would not indicate whether the source was impure or the contamination nearer at hand. It was impracticable to send a trained sanitary engineer over 15,000 miles of line to render a report on forty odd stations. So, with the help of the Florida State Board of Health we devised a questionnaire and sent it to each airport manager to be filled in.

We found that most of the large cities had modern water works where water was filtered and sterilized by up-to-date methods and presented no particular problem, but in the smaller ports the sources of water were of all kinds; wells, rivers, cisterns, springs, and some examples may be of interest.

In several ports rain water was collected from the roofs of nearby buildings in cisterns. Sometimes it was filtered and sometimes left untreated. The local inhabitants had drunk it for years and, if they had stomachaches or diarrhea, they attributed them to an act of God. In one port where analysis showed the cistern water to be contaminated and we had directed that all water be boiled, several months afterwards on a visit of inspection the airport manager thanked me profusely, stating that since the water had been regularly boiled and the drinking fountain sterilized none of his personnel had been ill, whereas before they had been frequently out because of sickness. Whenever possible we avoid the use of water from cisterns but when no other source is available we boil the cistern water.

In one case a well was the only source of water available. It was contaminated by surface seepage. In another a spring on the side of a nearby mountain was the only water obtainable. In the rainy season the water was contaminated. As we were not confident that the water would be properly filtered and boiled we directed that supplies of tested bottled

water be shipped in from other points.

One station in South America reported that the water was pumped from a well, filtered, chlorinated and inspected at frequent intervals by health officials. This sounded encouraging but our tests showed the water to be contaminated. No other safe source could be found, so we use bottled mineral water entirely.

The first survey showed that samples of water suitable for analysis could not be collected by issuing general instructions, for such instructions would not be followed unless close personal supervision was available. Each agent would have to be taught individually—which was impracticable, and the percentage of useful specimens would be low.

After discussion with our medical advisors and the Florida State Board of Health we arranged to have the samples collected by the stewards on the planes. The steward was provided with the necessary equipment in the use of which he was instructed before departure. The equipment consisted of 6 oz. sterilized bottles with a ground-in glass stopper protected by a paper apron held in place by a rubber band, metal containers for the bottles and a portable ice box. The samples after collection were kept on ice, sometimes for several days before reaching the laboratory. The ice preserved the samples perfectly. In no case where the same man handled the samples and ice box personally from the beginning to the end of the flight were any spoiled. It was only when they passed through several hands that difficulty was experienced. On arrival at Miami after being inspected by Customs, they were delivered to the storekeepers of the Stewards' Department, who checked the labels, re-iced the box, and delivered them to the Railway Express Agency to be transported to the laboratory in Jacksonville with instructions to re-ice. The Steward's instructions were given him in writing and might cover any point within the Eastern Division.

At an overnight stop and other important points samples were collected of ice supplied to the plane, water supplied to the plane from the plane's water tank, ice, drinking and tap water from the hotel where the passengers and crew stayed overnight, ice and water from the airport drinking fountain.

The result of this survey proved to be very interesting. Whereas we expected to find frequent contamination, in fact, conditions were fairly good. Some of the smaller ports in out-of-the-way parts were found to have a thoroughly good safe water supply; in others as could be expected the water was contaminated. One or two larger spots that were suspected to be filthy turned out to be excellent, but on the whole we were agreeably surprised to find conditions better than we expected.

When the water at an airport was found to be unsatisfactory it was comparatively easy to correct matters. We at once radioed the airport manager to boil for twenty minutes all water used in the airport or supplied to the plane, and sterilize the containers with the sterilizing compound which we immediately sent him. We then took another sample, and if the water was still reported as unsatisfactory we re-

quested him to find another water supply, which was tested.

When contaminated water or food was found in the hotel at which passengers and crews stayed the problem was more difficult to correct. Usually the cause was the same—handling of water bottles and ice with dirty hands or failure to sterilize all containers properly. Various methods were used to correct the situation. As the first step we advised the management of the conditions and urged that it be corrected. In a few instances this procedure produced results but sometimes it didn't. Then persuasion would sometimes help, but the economic argument proved most effective. Whenever possible we took our business elsewhere. It was remarkable how promptly this produced results. When these methods were ineffective the local health authorities were called in.

In one case the proprietor of a hotel where we found contamination threatened suit against us. Nothing came of it, but when I put in an appearance there several months later I found myself exceedingly unpopular. The cause of his annoyance was that someone besides himself had found the contamination. At first he maintained that our analysis was incorrect but finally admitted that independent chemists had confirmed our findings and that the contamination was due to the improper handling of ice for drinking water. The net result was a rebuilding of his kitchen and the installation at considerable expense of a cooling system for drinking water connected directly to the city water supply. I felt that the loss of a little personal popularity was a low price to pay for the results.

In another well equipped modern hotel the kitchen was filthy and even the threat of taking business elsewhere wouldn't work. Eventually a bacteriologist took specimens of the food, milk and scrapings from the kitchen tables and made a report. This report was sent to the owners of the hotel and also to the health authorities. It scared them and to heighten the effect we took considerable business away. We requested only such things as daily baths for food handlers, screening of the kitchen to prevent flies from the nearby privies lighting on food, non-absorbent table tops, and adequate refrigeration. The owners finally agreed and the improvements have been made but it took two years to accomplish.

Sterilization was not only necessary for water containers aboard aircraft, for cooking utensils and tableware, but also it was necessary to find a fool-proof method that would work under most conditions. Steam sterilization meant a bulky installation of considerable outlay. Immersion in boiling water was unsatisfactory unless carefully supervised. Sterilization by chemicals was more practicable but a disinfecting agent was needed that was simple to use, would not deteriorate, did not require rinsing in water after use, would not leave an after taste and above all was non-corrosive, particularly to the metals of which an airplane is made. The last two requirements prevented the use of many of the chlorine preparations.

Eventually we found a sodium paratoluene—sulfonchloramide prepara-

tion which seemed to have the characteristics we required. Our chemists tested it for corrosion of aluminum and found that a 10,000 p.p.m. of chlorine solution had for practical purposes no effect on a piece of welded aluminum suspended in it and exposed to sunlight for over a month. This test permitted us to use one disinfectant for all purposes, thus simplifying the problem of supply and avoiding the nuisance and danger of using the wrong disinfectant. The usual solution we use gives 400 parts per million.

Supervision of water constitutes only one part of Pan American Airways' sanitary problem, for the supply of sanitary food to the planes is even more difficult to assure than a safe water supply. A description of our catering methods is outside the scope of this paper except as it concerns sanitation. In general it may be said that our larger planes carry hot food in thermos under the care of a trained food handler, while the smaller planes carry cold food in the form of box lunches. All food is purchased from local caterers except in Miami and Rio de Janeiro where it is prepared in our own restaurants.

We have had to assure ourselves that the raw materials are fit for use, that the kitchen is clean and that storage and handling conditions aboard the planes are sanitary.

We depend on the local health officers, inspection of the food before cooking by our own stewards who are trained food handlers, and proper cooking to assure the food supplies being safe for human consumption. Our own men report all unsanitary conditions to our local representative and also on their return to Miami. Thereafter we bring pressure to bear in a variety of ways as previously mentioned—the most effective being economic pressure.

On the present planes no form of heat is available and we use vacuum bottles for food storage. The heat retaining efficiency of food jars manufactured for the picnic trade is not sufficient for our use, where food must be kept about 145° Fahrenheit for a maximum period of eight hours. When food is packed at sea level the pressure within the bottle remains that of sea level. When the plane climbs to 10,000 feet the usual cruising altitude, the pressure with the bottle is still that of sea level and the bottle and its seal must be strong enough to withstand this pressure. If we ease the pressure, the heat is ejected and when the plane descends cold air is forced in and the food cooled. The special equipment which we have had manufactured to meet our victualling conditions permits us to serve food that is hot enough to be safe and palatable. One vacuum bottle in particular which we developed for hot water storage retains heat so well that water placed in it at 212° takes 48½ hours to cool down to the Pasteurization point—145° Fahrenheit.

Further to safeguard passengers and crew against food contamination we have worked out sanitary rules for the kitchens in tropical countries which furnish food to our passengers or crews.

All water used must be boiled not less than 20 minutes, unless as a result of

official tests the water has been approved for use without boiling.

All dishes, silverware and kitchen utensils after washing must be sterilized by immersion in a sterilizing solution.

No uncooked vegetables may be served, specifically raw celery, lettuce, cabbage and radishes. All vegetables must be boiled not less than 20 minutes.

No local pork may be used in any form, including ham, sausage or bacon, whether raw, smoked or sugar-cured. Bacon, ham or sausage may be used only if it originates in the Argentine, United States, Germany, France and the Scandinavian countries and then only if cooked.

No fresh milk or cream may be used. Canned evaporated milk, condensed milk or powdered milk must be used for cooking or otherwise. Analysis of milk from a number of ports indicates that much of the milk is unsafe unless boiled. As we cannot supervise the boiling we avoid danger by using the preserved product. No locally made butter or cheese is to be used. Canned butter is safe provided it originates in the Argentine, United States, Great Britain, or Scandinavian countries.

Fresh fruits must be scrubbed with soap and rinsed with water that has been boiled or sterilized in a sterilizing solution.

To insure sanitation aboard all Pan American planes and airports we have worked out a number of rules for washing and sterilizing cooking and table utensils and drinking water tanks or fountains.

At each airport we have installed hot water facilities where dishes are washed with soap and hot water and then rinsed in clean water. Thereafter they are placed in another tank of water and the sterilizing compound poured in, where they remain for 20 minutes. Drinking fountains are sterilized daily.

Water tanks are scrubbed, rinsed and sterilized by the same method after each trip and at certain points on the line. At the instance of the Florida State Board of Health this work is now done only by medically examined food handlers.

In flight should it become necessary for the steward to rinse silverware or dishes, he is required to put sterilizing compound in the water.

In the handling of ice we experienced great difficulty in preventing contamination through careless handling by employees. To obviate this we have constructed in all water coolers and tanks special ice compartments so that the ice does not come in contact with the drinking water. We also insist that ice tongs and buckets be sterilized.

On board aircraft it is out of the question to install water flushed toilets owing to the necessary weight of water. On flying boats the waste matter is vented directly and at each port the toilet is thoroughly scrubbed by a porter, disinfected and deodorized with a pine oil emulsion. On land planes the waste matter is vented into a tank which is emptied at each stop.

Routine fumigation of aircraft by a cyanide process is carried out twice a year, but the planes are fumigated oftener should special circumstances require. This rarely happens as the routine cleaning and maintenance is such that there is little chance of an infestation by insects. All seat covers and upholstery are laundered or dry cleaned after each flight or at short intervals.

On arrival of a plane in Miami the steward's equipment is immediately washed and sterilized. Each vacuum bottle is taken apart and the inside of the casing cleaned and sterilized, for by experience we have found that food particles can collect and ferment between the lining and metal casing. Although it is ordinarily unlikely that this contamination could reach the interior of the bottle we have had the liquid collect in the lining and when the bottle was tipped it leaked out into the cup that was being filled.

Pan American Airways has another important sanitary function to perform in preventing the entrance into this country of mosquitoes which could cause an outbreak of yellow fever. The United

States Public Health Service has made a thorough study of the question and evolved the following method for our use: At least thirty minutes before the arrival of the plane in Miami or any United States port the ventilation is closed and the steward sprays the plane thoroughly with an approved insecticide. Although the spraying is thoroughly done the passengers seldom object because its odor is not offensive. The spray now in use is a combination of pyrethreum, pyrocide No. 20 and spraysene, which we prepare ourselves and has proved to be very effective. Partly as a test and partly for instruction, last spring we gathered together all the stewards who were in Miami and loaded them aboard a plane. When in the air the local head of the United States Public Health Service let loose 100 ædes Egyptæ, the mosquito which can carry yellow fever. There was also a cage of house flies on board the plane. The ventilation was shut off and the plane was sprayed. A while later we landed on the water when the plane was searched thoroughly by the public health officials. Not only were no live mosquitoes found but the spray had also killed the cage full of house flies. Certain other countries also required the planes to be sprayed before they reach ports and we feel it is exceedingly unlikely that live mosquitoes can be carried into this country aboard our planes.

The results of these efforts have been interesting. For a long time no new cases or stomach disorder have been reported among our passengers and crews, whereas earlier considerable trouble was experienced. We feel, therefore, that our methods in the main meet the problem, although further experience and study will show us ways to improve them. As in all sanitary work, vigilence is the price of success and we are constantly on the watch to detect any lapse into unsanitary ways. Ignorance has been our greatest obstacle and still exists but much progress has been made and more will come.