II. StratoFilm Flight Results

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Abstract

An overall success rate of 88.6 percent is reported for 114 StratoFilm balloons, and the 13 failures are discussed. The principal problems are due to damage inflicted during ground-handling of balloons made from the thinner gauge films currently being used.

Flight records for large balloons at Churchill and Palestine indicate that StratoFilm may have higher radiation-absorption characteristics than regular polyethylene.

As you know, data from the StratoFilm balloon testing program are obtained continuously. Since we wanted to give you up-to-the-minute data, we did not have time to reduce them to graphic form.

It has been about a year since the last Symposium when we discussed the new polyolefin balloon material called StratoFilm. I am happy to say that the high hopes held out for this material have been pretty much realized.

We have reports in our files on the flights of 114 balloons made from StratoFilm. In our tabulations we have eliminated the balloons that, through no fault

of their own, did not get off the ground — a sort of a base-on-balls concept in figuring batting averages! In other words, if the termination fired before the balloon was launched, we can hardly blame the balloon for that. We should also point out that our statistics are not all-inclusive since some of our good customers did not fill out and return our flight report form! However, I am sure you will agree that the results of the 114 flights are statistically significant.

Of the 114 reported flights, 13 were failures for various reasons. This shows 88.6 percent overall success. Of the 13 balloons reported as failures, only 7 were in-flight failures – giving an in-flight success ratio of 94 percent, the difference, of course, being the ground failures.

We have a pretty good history on the failures and the significant factors involved. I think it might be well, since there are comparatively few, to discuss each of these failures, not necessarily in chronological order. We have listed the balloons by size and by gauge, and the order in which they are given here just falls out of our listing.

We had a 2.94-million-cu-ft, 0.5-mil balloon that failed at Churchill at an altitude of about 50,000 ft. An analysis showed that the balloon probably failed from wind shear. There was a 40-knot-velocity wind differential in a 1000-ft difference in altitude. The instrument package, which was tied with a 1000-lb line, actually broke off the load line, so we figured that there were some pretty severe forces working on this one.

A 2.94-million-cu-ft, 0.5-mil balloon failed in India at 52,000 ft. The temperature in the tropopause was -79°C. The reason for failure is unknown. Another 2.94-million-cu-ft, 0.7-mil balloon in India was aborted on the ground. The balloon was released but there was no lift. Investigation revealed that helium was lost because of a snag tear. A second balloon of the same size, in India, also didn't ascend and was a so-called stump jumper. Since it went into the trees it was not possible to analyze the reason for insufficient lift. There was a third one on the India Program, also 0.7 mil and 2.94-million-cu-ft volume, which was aborted on the ground because of holes in its fabric.

Two of the very first balloons made from StratoFilm came out of our new Texas plant. Inexperience of manufacturing personnel probably explains the failure in the launch arm of two 2.94-million-cu-ft, 0.7-mil balloons in Panama. This was prior to the Symposium held last year.

Then, coming up in gauge a little bit, a 2.94-million-cu-ft, 1.5-mil balloon was flown by Goodfellow Air Force Base. It went up to 44,000 ft and slowly started to descend. It can be assumed that there was a hole in the balloon, but there is no way of authenticating this assumption. Then there was a 5.25-million-cu-ft, 0.7-mil balloon in Palestine which was a "ground abort" because of tears. The indications are that these came about because of handling problems. You

could definitely see the finger marks where the tears had started. Here again we don't know when they occurred. Another 5.25-million-cu-ft, 1.5-mil balloon flown by Goodfellow Air Force Base reached 47,000 ft and didn't go any higher. In Churchill, three of our 10.6-million-cu-ft, 0.5-mil, capped balloons did not reach and stay at altitude. One of them went up to 78,000 ft and slowly started to descend, and two of them went to ceiling and then slowly started to descend. I now believe, since we compiled these figures, that there was another failure on the balloons flown by Goodfellow. An unofficial report indicates one of the 2.94's went up to about 40,000 ft and slowly started to descend.

Looking at these figures you will note that five of the failures were 0.5-mil gauge. Six were 0.7 mil and two were 1.5 mil. We took a look at the size of the balloons in the total compilation to give you an idea of whether everybody was flying a lot of small balloons, where you can build statistics in a hurry, or whether the average represented larger categories. We come out with fifteen 10-million-cu-ft balloons (that is, approximately 10 million, as there is some variation), nine 5-million, one 4-million, and fifty-seven 3-million-cu-ft balloons. Now there were many other smaller balloons, under a half-million cubic feet, which we have not included in this compilation because we didn't think them statistically significant.

In our opinion, some of the factors that are most significant involve the India flights. I think that probably you are all familiar with this project. They did fly in tropopause temperatures down to -87°C and, in some cases, with fairly heavy loads.

In regard to the loads flown, one of the reported flights shows an 1800-lb load on a 2.6-million-cu-ft, 1-mil, capped, StratoFilm balloon. In India, there were two flights on 5-million-cu-ft, 1-mil, capped balloons. One had a payload of 2500 lb and the other 2800 lb. There were two 1300-lb loads flown on the 3-million-cu-ft, 0.7-mil balloons. As you probably know, most of the flights were conducted for cosmic-ray experiments, and the payloads were usually anywhere from 200 to 800 lb.

Apparently quite a few flights were made at Flin Flon by Schjeldahl Company with StratoFilm balloons, but we do not have the reports on them yet. The last we heard indirectly was that there were seven successful flights with one ground abort.

I think one of the other significant things we should consider is that apparently there were, at the most, one or two catastrophic failures of the type we were so concerned about in the past. It would appear that our current problems are in all stages of the pre-flight handling of the balloons – from manufacturing them through packaging and laying them out on the flight line.

We are particularly concerned with our own people and, of course, with anybody else who is handling balloons in the wrapper. It is still possible to grab the wrapper, even though it is 3- or 4-mil-thick poly, and damage the balloon inside. The ordinary technician has a tendency to grab a fistful of balloon and wrapper, and that can easily stretch the thin film. The tendency toward thinner and thinner balloon-film gauges makes careful handling much more important. Many of the flight operators are used to handling 1.5-mil film, and when you get down to 0.7 and 0.5 mil it certainly is much more critical. So in analyzing these figures it would appear that, as of this time, the handling problems are the most important problems that we face today, and I don't have any particular answers for them. From my own limited experience in handling balloons, I know that when things start to go there's always a tendency to start grabbing. Probably the best answer to this is for everyone to wear gloves so that they just can't grab hard.

Another phenomenon of StratoFilm balloons that we noted, particularly in our Churchill operation, is that they level off at a given altitude and after 2, 3, or 4 hours they drop down to a new altitude and then may go up again. Very recently, Mr. McCreary, in Palestine, told me that they are observing the same thing. These observations indicate the possibility that StratoFilm has considerably higher radiation-absorption characteristics than regular polyethylene. This is a subject on which we intend to do considerable studying and the Palestine group will follow up. They have observed a couple of flights during which the balloon went over a storm area, dropped down, and then went back up again after it passed over the storm area. I think that in the larger, thinner-gauge balloons, radiative energy becomes a more significant factor. The resolution in altitude measuring is often not accurate enough to point up many occurrences in smaller balloons.

Well, I think these remarks cover everything that I have to report at this time. I'd like to say that we would appreciate getting as many reports as possible to make the results more statistically significant, and we appreciate very much the cooperation to date by everyone in this program.

Thank you.