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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Goddard Space Flight Center

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INTERVIEW OF

DALE MEYERS

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June 28, 1973

(TRANSCRIPT OF TAPE RECORDING)

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(TAPE 1, SIDE 1)

: .... Administrator for Manned Space Flight, held on June 28 ....

: Just talk as fast or slowly as you want.

MR. MEYERS: Okay. I am Dale Meyers, Associate Administrator for Manned Space Flight, NASA.

The first indication of a problem that we had with the Skylab was about twelve minutes after launch when we were in orbit and we got indications from our telemetry data that the workshop solar panels had not been deployed.

Shortly after that we realized that we had indication that the micrometeoriod field was gone. We stabilized in solar inertial. We extended the ACM. We extended the solar panels for the ACM, and we were in the proper altitudes, proper attitudes, and proper conditions for joining it with the launch that would have occurred the following day.

We finally realized that the workshop micrometeoriod field was missing and that the gold capton covering of the workshop was absorbing heat tremendously. Temperatures were rising upwards to about 300 degrees Farenheit, and we realized very quickly that we had to immediately do something to decrease those temperatures.

Our first approach to that problem involved changing the attitude of the workshop up to about 45 or 50 degrees.

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That decreased the amount of power output of the already limited solar panel that we had. But we increased the attitude as high as we could go and still maintain the housekeeping capability of the workshop itself.

At that stage of the game we were working with our previously calculated specification limits for the vehicle, and it was -- there were some fairly tough decisions that were made to change attitudes because we had never designed to these conditions of flight. The workshop had been designed to be solar inertia oriented, or (v-local) vertical oriented, and had never been designed to be operated with either the back end towards the stern or the front end towards the stern on a continuous basis.

As you can imagine, we had a lot of strongly resisting imputs from the technical people because they didn't know enough about the system yet to be able to feel comfortable about exceeding the limits of the system.

By going the 45 to 50 degrees attitude we were discharging batteries much deeper -- a much deeper discharge of the batteries than we had previously designed for, and the people at Marshall were very worried about damaging the batteries.

At that time we didn't have much discussion about the high temperatures on the front face of the ATM, or the low temperatures in the workshop area that resulted at being

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at this 50 degree attitude. But later we found that we had some-- had done some damage to batteries at the front end, and had almost frozen the (suit loop) at the back end of the ATM down in the workshop area.

We very early decided that we had to do something to get away from this position. We were at a 50 degree attitude so we couldn't look at the sun with the ATM; we couldn't look at the ground with the Earth Researches equipment because of the fact that the batteries would discharge if we did that.

The temperature inside was about 125 to 130 degrees which was on the limit of the food and was above the limit of some of the film that we carried aboard; and in fact we were dangerously close to the limits of the electronics equipment.

So we were in the position where you could just barely sustain the workshop without destroying it and could do really none of the medical experiments because of the internal temperatures; none of the ATM and none of the (Sealab.)

I really don't know who first thought that we needed a sun shield put up over the system. It seemed to be that everyone recognized this almost immediately. And of course my problem with defining the story that unfolded from that point forward is very difficult to define in terms of days, because none of us slept very much for the next few days, and the times of meetings are very fuzzy in my memory. I would

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have to go back and look at my overall schedule to define when those meetings were held.

The first thing we needed is a sunshield. I made it very clear to our people that I wanted all the ideas we could get. We wanted to convass our centers, the other centers of NASA and the industry for idea, and in fact we even had ideas being sent in by mail to us from the outside public which we were reading very carefully.

Immediately the three centers of the Manned Space Flight organization went to work developing ideas. Even the Kannedy Space Center, who is not normally thought of as a development center, had a group of people thinking ofideas for decreasing that temperature.

It all finally developed to the idea that you had to cover the gold capton some way.

Some of the ideas that were discussed included -- wait, could you hold --

(Interruption in tape.)

(Tape becomes very low and garbled.)(Next 4 lines.)

This is the first day after the launch and

we had scrubbed the launch of the Skylab

Skylab too and we had delayed it for five days while we tried to regroup and understand what we were dealing with. Some of the ideas that were developed were alternate like, "Fly the Skylab II, dock to the workshop, but enter

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the multiple docking adaptor only carrying food like Apollo food in the CSM and running a 15-day mission with the ATM only."

These kind of ideas were developing because at that time we really wondered whether we could ever inhabit the inside of the workshop. Temperatures were still climbing. We were seeing the film vault temperatures going up to where film was losing its quality. We were asking questions of ourselves about the structureal limits of the workshop and even wondered if we would be able to get into the workshop at all.

On the 15th we concluded that because of the workshop -- it had originally been an F4B pressure vessel that took 38 pounds pressure, our 300 degree Fahrenheit temperatures still showed that we had safety factors that were very good.

On that day we recognized that we must cover that gold and ideas began to develop on how to do it.

One example, for example, is that we had the thought of using regular black spray paint. No one had ever thought of using a spray can in vacuum, and the fellows down at Johnson put a spray can inside a vacuum chambers, and most of us were betting that it wouldn't work properly, they -- but they tried a regular store-bought can of paint, enamel, I think, and at a 12-inch distance, inside a perfect vacuum, it did a beautiful job of spraying paint.

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One reason we didn't use that idea later was that it took a lot of paint to cover that 20 by 24 gold capton area of the workshop, and would hae taken some good precision in EVA to be able to handle the paint can that way.

That is an example of the kind of ideas we were d eveloping. We turned to our centers and the industry and ideas began to develop very rapidly, such as the paint can, the use of extendible metal panels. Walter Burke of McDonell-Douglas came to me with the idea of a tool that would take a roll of aluminum -- thin aluminum metal and actually put a extend -- entend it over a bending machine that would make it sort of a "W" shape, and -- in two pieces -- would extend a long tip of aluminum down over the exposed area, and then move the tool two feet to the side and extend another one, and move the tool two feet to the side and extend another one.

It was another one of the ideas that industry came up with.

We looked at things like window shades that could be extended. We looked at cloth rolled up with wire springs that could just be released and it would unroll down into -- or out into space and then could be lowered down on the surface. We looked at inflatible systems of all sorts.

About the -- we were still extending to industry the invitation to come up with ideas. In the second and third day. And by the third day we realized we would not be

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able to launch 5 days from the launch of Sklay I, and arbitrarily moved out to 10 days.

It seemed to be very important that we get up there soon because we were continuing to jeopardize our systems, and although ideas were developing and were in test, none of them had developed to the point where we felt comfortable with flying them.

So we did move to the 25th as our launch date, and narrowed down to about 4 possible systems to fly. One was as -- incidentally, these four systems all had different advantages. You must remember that we did not know the condition of that workshops external surface. We knew that the micro-meteoroid field had been ripped off, but we didn't know whether there was debris extending several feet out from the surface of the workshop.

So all of these parasols and sails and devices that we were developing were trying to be developed such that we could lay them down over debris that extended from the surface.

Four ideas became important ones about four days before lunch. One was a -- was called a "Stand-up EVA sail" that would be extended from the command service module, and tied to the ATM area.

One was what we called the "twin pole" system. And by the way part of the problem was getting names to describe the various devices that we were dealing with. But the twin

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pole system was one developed by Marshall, had been tested in the neutral bouyancy facility with a back-up crew, and was operated from the ATM EVA stations so we had good confidence in being able to operate in that area.

Another idea that was developed came out first as the use of four fibre glass fishing poles with some material on it that could then be extended like an umberella over the area, and developed later into a series of aluminum poles.

That one was the one we finally used, but we actually stowed three that I talked of so far.

There was another one, an inflatable system using the material that had originally been used in the Echo baloon, that was developed by the Langly people. Ed (Coright) and his people put a tremendous amount of effort into that one, along with the efforts which everyone else put on this system. And their system was almost carried, but we finally decided not to carry it because we could not insure that its inflation process would keep it away from the surface or the skin of the workshop. And we were afraid, with sharp-edged debris on the surface of the workshop, that we could puncture the -- that inflatable system and we would be left with no coverage.

In retrospect, looking at the surface of the workshop from space, there was so little debris on it thatwe probably even could have used that inflatable system.

I think the series of meetings and communication that

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went on in that 10 days between our understanding the problem and our solution to the problems was an outstanding demonstration of people in crisis working together.

There was every opportunityfor us to have -- for us to miss some communications or tempers to get short to where perhaps someone would not bring up a subject that was disagreeable. But in this period of time I have neverseen a group of people, government and industry, work together so closely with so little sleep and with so much progress.

When we were ready to go, when we were ready to stow these systems, one day before the launch, we knew exactly the design -- we had had preliminary design reviews of each of the systems. We had critical design reviews. Each of the systems had been trained on by the back-up crew. Each of the procedures had been written up, such as they could be transmitted to the crew. Documentation with respect to testing materials, flamability, all the elements of a normal development program had been completed, but had of course all been done in a period of 10 days from idea to finished product.

We finally decided in the last meeting that we had prior to launch that we would use the internally deployed parasol as our first choice because we would rather not use EVA for extending the system, and although the material on this parasol was not expected to last for the full 8 months, it did appear that it would last through this first mission

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at least, and we believed that we had a safer deployment by doing this, as an internal deployment process.

The people that were involved that I remember being so much involved in the operation were people like Jack (Kinsler) at Houston who came up with the idea of the parasol. Max (Fergay) -- oh boy -- I'm thinking of a preliminary design guy down there. Ken (Frankanac) Ted (RoJohnson) and a series of people in the testing area, materials areas, and the industry that actually supported that around the clock operations.

Down at Marshall the people who came through very clearly to me in the operations were Bob Johnson on the twin-pole system, Lee (Baluu), and (Kinsberry) and of course (Rocco) and Cris were right in the middle of every bit of the development activity -- Rocco (Petrone) and Cris (Craft.)

Now in the course of understanding all these activitie in those 10 days we continued to get up-dates on the thermal condition of the system, the power condition of the systems, and where we stood as far as our capabilities of the workshop to carry out its missions. And even up to the launch of Skylab II we still had questions as to whether we could carry out a 28-day mission.

We knew we had power aboard the CSM that could give us some additional power in the workshop but we also knew that with man aboard we would have more power required.

We had overcome some of the original conservativenes of the people concerning their various subsystems, and from a

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management standpoint had made decisions that would have taxed various of the subsystems such as the power system, the battery system, the thermal system. If we had followed the advice exactly that had been submitted by the subsystem managers.

But another pleasant understanding as crises of this type develop with the technical people as they understand the situation, are able to immediately communicate to the management people that their system is in fact operating better than they had expected, and gave us an opportunity to make decisions that made progress in overcoming our overall problem.

I think it is significant that by about the third day of flight, when our temperatures began to stabilize, we in management began to feel reasonably confident that we could make a 28-day mission.

It was only after losing the recharge capability of four of the batteries that we felt a loss of optimism about the 28 day mission. We were again losing our power, and that loss of the battery recharge capability was diretly chargable to the high temperatures that were imposed on them when the vehicle was at a 50 degree attitude.

And losing our power tended to lose our confidence in completing the 28=day mission. That is when we decided that we must do an EVA to get the remaining solar panel open.

Has that been talked about?

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: No.

MR. MEYERS: Because I think it is all part of that same story.

: No, not .

MR. MEYERS: Okay, let me go on withthat then.

When we lost those battery recharge capabilities was when we ran our first full Earth resource experiment mission with the Skylab crew aboard. I think it was day 3 or 4 of the Skylab II mission. When we go z (local) vertical, we lose a lot of the solar energy, and the solar cells are the windmill of the Skylab. And that deep discharged the batteries. Four of them did not recharge on that pass, and one actually dropped off the line.

Now this was the second charger battery regulator module that we had lost, and at the rate we were losing them we were going to run out of power very rapidly because each one of those battery modules was worth about 250 watts of powe

We had had enough information from the crew as to the condition of the one remaining solar panel that we were reasonably convinced that the solar panel was in good shape, had been deployed normally in space, but was being restrained about -- by a three-quarter by one inch aluminum angle iron which was part of the micro-meteoroid field-- shield.

Apparantly in the micro-meteroid shield had been thrown back and over the solar wings. When the sola

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wing was released the wing only moved out a few degrees and then was restrained by that angle iron -- aluminum angle.

The crew had visually inspected it during their EVA fly around prior to docking and had even tried in their extra-vehicular activities to bend that angle away from the solar panel. But the particular angling that the piece of metal came up oer the solar panel was such that they could not get a good purchase on it in their reaching for it with the tools that they had carried along in the CSM.

Parenthetically, I should say that those tools are an interesting story in themselves. When we decided that there would be debris on the workshop,a day or so after the launch of Skylab I, we decided that we should look for tools that the crew could take with them so that could do a stand-up EVA and cut debris away from the wing, or bend the debris away from the wing.

We finally went to the telephone company because of their work with high wires and high lines to see what they had in the way of long pole operated tools. They had three that we finally decided on.

One was a bolt cutter, one was a tin-snip, and one was a bending tool that really looked like two kinds of a weig about an inch and a half apart that gave an opportunity to put those two prongs around the piece of metal and then by twisting the handle or by pulling on the handle you could move

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metal from some distance away.

These tools then were adapted to some poles that were used for the twin pole thermal field and allowed the guys to have tools that they could operate about 15 feet away from the hatch of the command module.

They tried to bend that strap away. They tried to reach the strap with the cutting took, the bolt cutting tool but could not get a purchase on it from their CSM.

But at -- in the meantime they had gotten a good look at it and had descri-bed/what it looked like tothe ground.

End of parenthesis.

On the ground the back-up crew who had worked so hard in training for the external thermal shield -- and I think here Rusty (Schlieker) was the guy that was deeply involved. Rusty and his other back-up crew members began developing with the Marshall people a technique for losening that strap and for extending the solar shield.

They worked out in the neutral bouyancy facilities and found that if they could restrain the (feet) at the edge of the workshop, they could reach down to 25 feet required, engage the bolt cutter on the strap, tighten the bolt cutter so you had a good purchase on it, and then hand-over-hand go down that 25-foot pole in EVA and find a purchase, a good purchase for the bolt cutter on the strap by manually re-adjusting the location of the bolt cutter, and then have the

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second crew man back at the end of the workshop pull on the rope that would cause that cutter to cut.

They had a lot of difficulty in locating the cutter the first time, getting the bolt cutter on the angle, but they did this while they were out of communication, in between stations, and in fact did the whole cutting operation while they were away from us, as far as communications were concerned.

They then attached a rope down about half-way down on the solar panel, tied the rope to the ATM (truckers), stood up under the rope, such as to cause tension to be applied to the solar panel itself, and actually had to break a bolt that was underneath the solar panel in order to reach -- to release the solar shield itself.

This was all done while they were out of communicatio with us. When the bolt broke and the solar panel began to extend we learned later that both crewmen were thrown off of the workshop out into deep space, restrained by the now slack rope, and their umbillical hoses. They never commented much on that, but the later recorded voice that was dumped to another station and thenread back to us had their only comment as a "Whoops" as they went off into deep space.

I think the courage and ingenuity in developing from the procedures on the ground the workable procedures in space is really beyond the call of duty.

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They showed their dedication to the experiments of Skylab was of the highest order, and that theyput their own ingenuity and their own safety on the line in extending that solar panel.

Now the -- with the solar panel extended -- and that was done by Pete Conrad and Joe Kerwin, we were essentially out of trouble as far as power was concerned. With the parasol working just about perfectly we had the thermal situation of the workshop under control.

So we really had salvaged the whole operation except for those experiments that we could extend from the -- that we should have extended from the solar oriented scientific air locks, which, of course, now contained the parasol mechanism.

I think the whole operation was one of outstanding confidence on the part of the technical people that were involved, andabsolutely unparalleled series of inventions, communications, decision processes, and operations that led to a completely successful recovery of an otherwise hopeless situation.

We had an opportunity here to demonstrate, of course, dramatically, what man can do in space. But more than we I think began to carry out in Skylab what will be a tremendously exciting set of experiments that now the American public will know more about, probably because of the dramatic rescue, this

-- rescue of this mission was done.

My own view of the results of this activity is that the american public will perhaps be more vocal in their support of the space program.

I say more vocal because, as I see it, the american is in full support of the space program, but is a silent majority. Perhaps this tremendous demonstration of the american genius in action may evoke more vocal support by the public.

: That's beautiful.

(END OF TAPE RECORDING.)

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