PANEL*

Stabilization Problems in Military and Commercial Aircraft

MODERATOR

Mr. Ernest H. Pallme — Chief Engineer, Aeroflex Laboratories Incorporated, 34–06 Skillman Ave., Long Island City, N. Y.

PARTICIPANTS

Mr. Horace J. Alter — Senior Design Engineer, Preliminary Design, Convair, Division of General Dynamics Corporation, San Diego, California

Mr. Raymond I. Beck — Photo Installation Engineer, Douglas Aircraft Company, El Segundo, California

Mr. Irving W. Doyle — Division Manager, Systems Division, Fairchild Camera & Instrument Corp., Hicksville, N. Y.

Mr. Tom E. Levick — Staff, Bomber Weapons Unit, Boeing Airplane Company, Seattle, Washington

Mr. Eldon Sewell — Photogrammetrist, Engineer Research & Development Lab., Corps of Engrs., W-P AFB Ohio

Mr. Wilton Stewart — Project Engineer, Hycon Manufacturing Company, Pasadena, California

INTRODUCTION

Moderator Pallme

THE participants in this PANEL are entitled to a vote of thanks because of their willingness to assist despite very short notice. Three days ago was the earliest that any of the participants knew of the desired assistance. One knew about it less than an hour ago.

The subject for this Panel Discussion is stabilization of military and commerical aircraft. What does stabilization mean in this connection? In general it is controlling something where you want it to be and keeping it that way. If you want something to be in a vertical position, you want to put it there and keep it there.

Our discussion is to be restricted to the narrow field of aerial camera, because stabilization in general is a very broad field and goes far beyond what we can cover here.

History of Stabilization

MR. ERNEST H. PALLME,
Aeroflex Laboratories

WHAT has happened in the past in stabilization? A brief review may be interesting.

The earliest recorded data that I have are from the thirteenth century. An architect named Honicourt wrote a report on a six gimballed hand warmer used for bishops to keep their hands warm during their religious ceremonies. It was stabilized and pendulously erected to keep the cinders from falling out and burning the bishop's robe. People were thinking about stabiliza-

* Held during Society's Semi-Annual Convention and Trade Show, Statler Hotel, Los Angeles, Calif., Sept. 7–10, 1955.

tion before then because he made a six-gimballed system to eliminate gimbal-lock. Of course, as in so many elaborate systems with six gimbals, he did not eliminate gimbal-lock.

The first instance of instrument stabilization was in 1537; a shipboard compass was pendulously erected in gimbals. It was even proposed that on shipboard the man reading a sextant sit in a stabilized bucket. I have no record that this system was actually tested.

The first stabilized aerial photography was done in 1858 by T. T. Tournicot, a French balloonist. The results are not known by me.

The U. S. Geological Survey attempted stabilization in 1918 and the Army Air Corps in 1921. These systems were given up primarily because of lack of good components. They were brute force gyro approaches, and there was not enough then known about gyros to do a good job. The British developed a brute force, gyro-stabilized camera mount in 1945. That one came much closer to doing a job. Their report is interesting in showing that they had the same problems we have had in the last few years. We presently feel we know more about these problems and some of the answers.

Dr. Baker flew a single point suspension mount in 1946 in some work at Harvard. The results from his tests were highly improved resolutions. The first U. S. Air Force production stabilized mount was the A-28 mount. It was a dressed-up, completely Americanized production version of the Steinheil mount developed originally in Germany for the U.S.A.F.

The principles we have been developing and will be discussing today, are those that have existed and were under process of development many, many years ago.

Talking about aerial camera stabilization makes evident that there are really two categories of stabilization. We started out looking for good verticality. The Steinheil mount and the A-28 mount were designed primarily from the standpoint of verticality. There are limits to what mounts can do in improving verticality. While verticality was the reason for getting into the stabilization business, our investigations showed that there was a lot more to be gained by stabilization. The steadiness of the camera while the shutter is open results in improved photography, higher resolution, and the ability to get more information out of the photograph. Earlier today vibration in helicopters was discussed; this type of steadying could well apply in the helicopter field.

There are many related problems and some will now be explained. We will start with Mr. Levick.

Some Problems Involved in Military Reconnaissance Requirements and the Application of Stabilization to Their Solution

MR. TOM LEVICK,
Boeing Airplane Company

IN AERIAL reconnaissance it is more important to locate and identify targets than to maintain camera verticality; therefore camera steadiness is the prime interest in stabilization.

Stabilization of the long focal length cameras which are needed to record detail from a high altitude, results in pictures of much higher quality than could be obtained if the cameras were mounted in conventional fixed mounts. This is especially true during night photography; the combination of long film exposure and aircraft motion would result in excessive image movement on the film.

Boeing recently completed a series of high altitude, night photo tests using a stabilized camera. Exposure time was approximately one tenth of a second; image movement due to forward motion of the airplane was compensated by moving the film during the exposure. The resolution of the photographs thus obtained averaged sixteen lines per millimeter with