

Blacking out of vision has limited the sharpness of turns and pull-outs which fighter pilots have been able to withstand ever since World War I. The black-out is due to the pull of gravity (G) on the blood stream when the direction in which the body is moving suddenly changes so that the blood's weight is thrown from head to feet. The heart is unable to pump sufficient blood to the brain when the pull of G causes blood to pool in the abdomen and legs.

During World War II, both the Allied and Axis air forces have experimented with various methods which would combat black-out. Since the pursuit airplane is able to withstand more G than the human body, the pilot with superior G tolerance should be able to outmaneuver the enemy. The earliest workable G suits were introduced by the Canadian and Australian air forces, followed closely by the U. S. Navy. The AAF modified and adapted the 18-pound Navy suit after extensive tests on the human centrifuge at the Aero Medical Laboratory, Wright Field, Ohio, and evolved the G-3 suit. This is, in essence, a pair of pneumatic pants weighing 2 pounds and containing air bladder which automatically fill with compressed air from the airplane's vacuum instrument pump. The pressure is released when the airplane levels off. The effect of the air pressure in the bladder is to keep the blood from rushing to the lower extremities of the body and pooling there. While the extra G tolerance provided the pilot is theoretically limited, fighter pilots wearing the suit have never reported a complete black-out.

Several thousand G suits were shipped overseas to fighter groups in 1944, and, unlike many items of personal protective equipment, they achieved immediate popularity among the men who have to wear them. Pilots have contributed case histories of kills attributed to the extra margin of clearheadedness the G suit gave them during pull-outs and turns. Equally important, the device reduces the fatigue frequently resulting from aerobatics.

### ***The Flak Suit***

More than 600,000 flak suits and helmets have been procured for the Army Air Forces by the Army ordnance Department since this type of body armor for bomber crews was originated in the Eighth Air Force by Brig. Gen. Malcolm C. Grow. A flak suit, made of overlapping steel shingles in a quilt-like cover, was designed to protect the vital areas of the body after it was observed that low velocity shell fragments from anti-aircraft and aircraft cannon were responsible for 79 percent of all wounds occurring among heavy bomber crews. Original models of the flak suit and helmet have been improved by a number of modifications. Body armor has been provided for every bomber crew member, and skepticism among fliers as to its value has largely disappeared. Eighth Air Force studies showing the value of body armor in combat have been supplemented by new figures from the Fifteenth Air Force.

The AAF is now battle testing a new combat helmet, also developed by General Grow, with excellent results thus far. Unlike

the conventional one-piece model, this helmet is a flexible, five-piece, close-fitting helmet. The older type weighed 3 pounds, the new one weighs 2 pounds, but experiments are being made with thicker steel. Visibility is improved. In battle tests the Grow helmet has shown that it has notable advantages; if further tests confirm them, it will be generally used by the AAF.

### ***Aviation Psychology***

The RAF paid the AAF a compliment in 1944 by adopting our system of air-crew selection and classification. Our psychological testing procedures were also adopted by the Free French.

The battery of 20 psychological tests used for classifying all candidates for pilot, navigator, bombardier, and aerial gunnery training have proved valid in predicting not only an aviation cadet's chance for winning his wings but also the flier's chance for combat success. In a follow-up study of both bomber and fighter pilots in the European theater, it was determined that pilots who had scored

highest in the psychological tests administered before they learned to fly tended to be rated by the squadron commanders as most successful in combat. Likewise, those who had the minimum acceptable scores appeared to be most frequently "missing in action."

The Aviation Psychology program in the past year has been extended to a point where it contributes to the number of bombs which hit within the target areas. It has been observed that bombing accuracy, as far as the human element is concerned, depends largely upon the ability of the navigator to set a course to the target area and upon the ability of the bombardier to identify the target and direct his bombs to it. The practice of using Pathfinder airplanes to mark a target and of the units of a formation to drop their bombs on a sig-

nal from the lead airplane places a premium on the proficiency of the lead navigator and the lead bombardier.

To aid the commanding officers of heavy bombardment groups in selecting the men best qualified for these key positions, psychological aptitude and proficiency tests have been adopted and are now routine in the European theater. A detachment of aviation psychologists studied bomb strike photographs in a 3-months' series of missions against Germany and found a definite correlation between the accuracy of lead bombardiers and the original aptitude test scores they had received a year or more before, when they were untrained. The Aviation Psychology program has paid off in time, lives, and money saved, and through its selection of the raw material has aided in the establishment of an effective combat air force. This has been done at a total cost of less than \$5 per candidate tested.

### ***Altitude Training and Personal Equipment***

The personnel mainly responsible for training fliers in the

