the T-38

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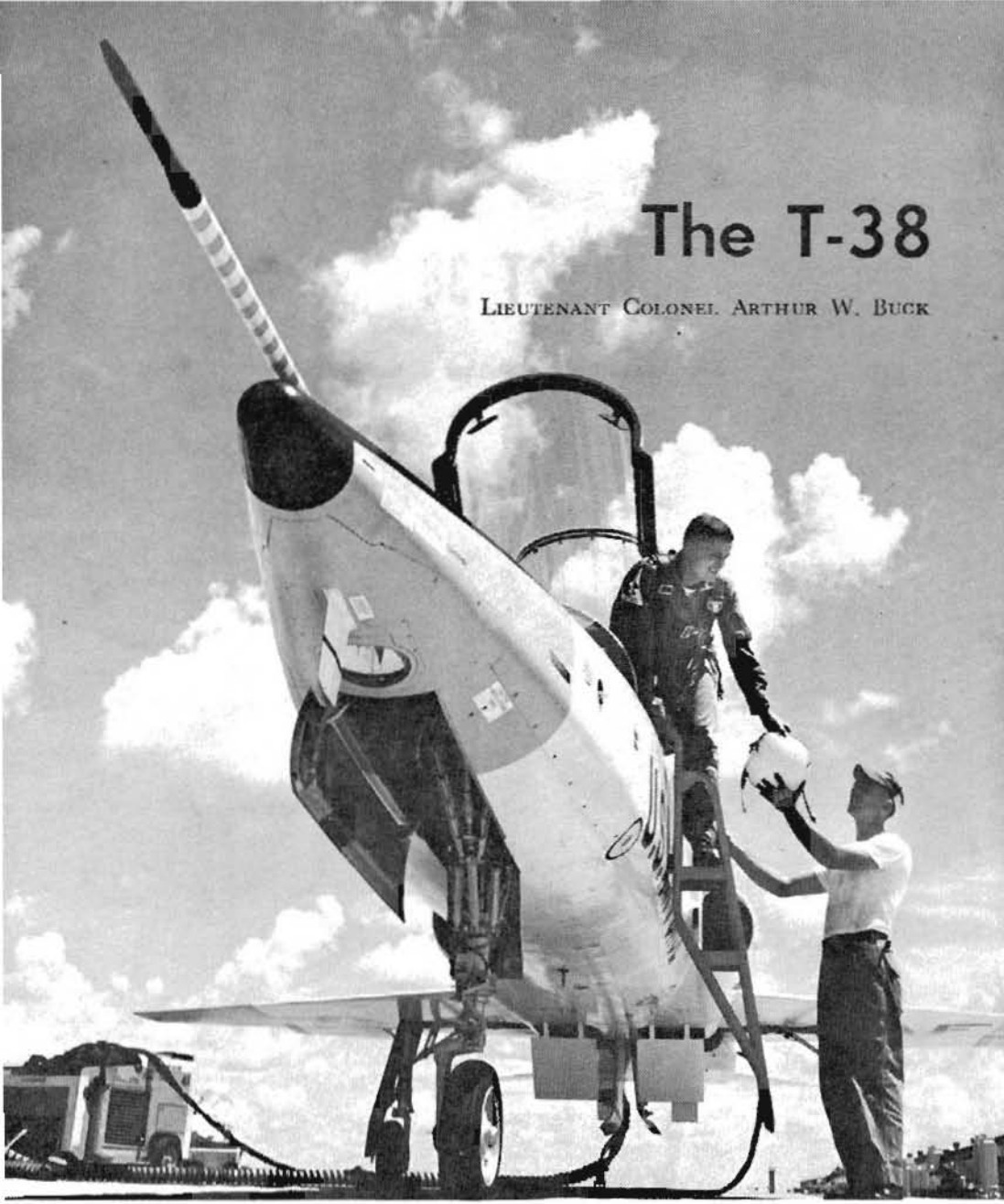


The T-38

LIEUTENANT COLONEL ARTHUR W. BUCK

TRAINING for war takes time. Unfortunately we no longer have either a cushion of time or a cushion of space. Both have been drastically reduced by high-speed aircraft and missiles capable of carrying nuclear weapons of tremendous destructiveness. D-day will likely be not a day of mobilization but rather a day of decision. That

is why the Air Force is geared for immediate combat readiness. Tactical units must focus their attention on preparedness and can spare little time for fundamental training of aircrew input. More than ever before the Air Training Command is responsible for producing highly trained, capable pilots who are skilled in the basic fundamentals—pilots who can reach a state of combat readiness within the tactical units in a short time. This does not mean that the Training Command will specialize. It will continue to produce a well-rounded pilot, but a pilot capable of transitioning to advanced Air Force aircraft with a minimum of additional training.

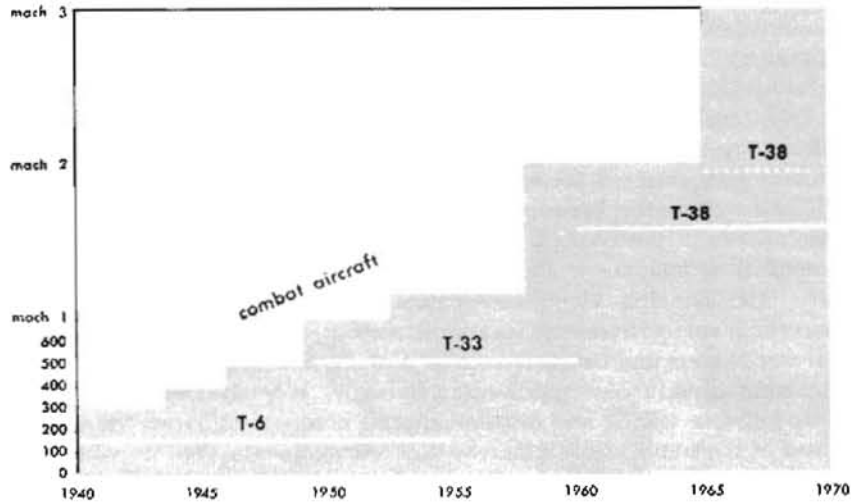
Air Training Command policy has always striven for parallel development of trainers along with combat aircraft. As the capability of our fighters and bombers increased, the speed and performance of the training aircraft were improved accordingly. Whenever the performance gap between trainer and first-line aircraft becomes too large, the training load of the combat unit is increased. For example, in 1948 it was realized that the new jet aircraft coming into being—the F-84, F-86, B-47, etc.—required training that could not be adequately supplied by the available trainers, the T-6, T-28, and B-25. The T-33 was introduced as a basic trainer.

The T-33 has done well as a basic trainer in past years, but now the performance gap has opened up again. The supersonic, high-altitude flight performance of the fighters and bombers now in the USAF inventory has again advanced the problem in flying training. Since the T-33 is unable to prepare the student pilot adequately for flight in the century-series aircraft, the training load has been slipping back on the combat crew training program and on the first-line units themselves. It has caused an increased requirement for two-seat, trainer-fighter versions of tactical aircraft. These fighters are costly to operate, and inevitably some combat capability is sacrificed with the addition of the extra cockpit.

In anticipation of this problem Air Training Command set a requirement in 1953 for a new aircraft to succeed the subsonic T-33 as the basic trainer. The general operations requirement for the replacement was completed in 1956, calling for a "lightweight economic basic trainer" capable of preparing pilots for operation of "high-speed jet aircraft of the present and the future."

Now the T-38 Talon is a reality and will soon replace the T-33 "T-Bird" as the Air Training Command's basic trainer. Questions naturally arise: "What effect will this high-performance training aircraft have on the training program?" "What will the impact be on the first-line units?" The answers to these questions will not be fully known, of course, until the completion of the present Category III Test Program and until the first T-38-trained graduates are combat-ready in operational units. Our present experience does enable us to make certain assumptions and draw conclusions from them.

Speed Comparison
Trainer vs. Combat Aircraft



impact of the T-38 on ATC

First, let us consider the physical impact of the aircraft within Air Training Command. The free utilization of airspace is becoming increasingly restricted and the high-performance characteristics of the T-38 will only add to this problem. If the student is to receive realistic and effective training, maximum-power climb corridors and supersonic flight areas must be established. Supersonic flying must be closely regulated to avoid unnecessary hazards and community relations problems. On the positive side, the high cruise altitudes of the T-38 should alleviate some congestion at the lower altitudes.

Basic Trainer and F-100F Capability

1960 Requirements	Capability T-33	T-38	F-100F
1. Transition			
Solo flight	•	•	•
High sink rates		•	•
Subsonic flight	•	•	•
Supersonic flight		•	•
High-altitude indoctrination		•	•
Acrobatics	•	•	•
2 Instruments	•	•	•
Extreme attitudes		•	•
3 Formation	•	•	•
High altitude		•	•
4 Navigation	•	•	•
High altitude		•	•
Supersonic dash		•	•

Little physical modification of ATC bases will be required to accept the T-38, which can operate from any adequate T-33 runway. The Talon's twin afterburners produce a much shorter take-off roll, and the T-38 landing roll is nearly equivalent to that of the T-33 despite a 25-knot increase in touchdown speed.

The maintenance impact of the new trainer is not as great as might be expected, although an extensive training course is required for ground crewmen and specialists. The amount of ground equipment required to maintain the T-38 is not greatly increased over that for the T-33, but it must be procured with the aircraft. Gas-turbine units are required for starting, and liquid-oxygen equipment is needed to service the Talon's ten-liter system.

The quick turnaround characteristics of the T-38 are reminiscent of the old T-6 days. The black-box concept, used extensively in the T-38, allows replacement of an entire component rather than requiring on-the-spot maintenance. Single-point, high-pressure refueling and the capacious liquid-oxygen system, which requires only one filling per day, make the sleek trainer ready to go within minutes after landing.

Performance Comparison

Performance	T-33	T-38	Typical 1965 weapon system
Cruise	0.70 M	0.90 M	0.95 M
Maximum speed	0.80 M	1.60 M	3.0 M
Service ceiling (take-off weight)	45,000 ft	55,000 ft	75,000 ft
Landing-pattern speed	160 K	180 K	200 K
Approach speed	120 K	140 K	170 K
Landing attitude	normal	nose high	nose high
Engines	1	2, with afterburners	2 plus, with afterburners
G stresses	7.33	7.33	7.0

The man-hours of maintenance required for each hour of flying time will not increase greatly over those presently spent on the T-33. Although the aircraft is still in test status, it is already operating at approximately 30 maintenance man-hours per flying hour. By the time the T-38 reaches the training bases, it is programed to be operating at 14 hours per flying hour. This compares favorably with the 10 hours the T-33 now boasts after more than 10 years of operation. Maintenance and operating costs will be slightly higher for the Talon than for the T-33, but still quite nominal in view of the added performance.

How will the new trainer affect the instructor personnel already in ATC? Thus far, we have experienced no difficulties in checking out qualified T-33 instructors in the T-38. Present plans call for T-33

instructors to receive a 37-hour academic course and a 35-hour flying program to qualify them as T-38 instructor pilots.

Next, let us consider the effect of the Talon on the pilot training program and on the student pilot. The present T-33 program has recently been increased to 130 hours to make its graduate more proficient and to introduce low-level navigation into the training syllabus. The T-38 program will be another 10 hours longer, for a total of 140 hours. This increase is being used to strengthen navigation and formation flying, the areas where first-line units felt additional emphasis was needed.

Comparison of total flying hours does not give the entire picture. The T-38 is not restricted by its fuel load from any maneuver, including landings, and it spends very little time in reaching its working altitude. Thus a greater variety of training can be accomplished on a shorter training mission. The T-38 syllabus of 140 hours represents approximately 100 training sorties as compared with 80 missions in the 130-hour T-33 program.

From a student standpoint the step from the T-37 primary jet trainer to the T-38 should not be a difficult one. He will already be experienced in normal jet operating procedures and in multijet operation. The student will of course have some initial difficulties in coping with the high performance of the Talon. The increased stall speed of the T-38 requires a higher final-approach and touchdown speed. The quicker acceleration and the tremendous increase in rate of climb (30,000 ft/min at sea level) will require a longer pre-solo period for the student to become acclimated. But from a purely mechanical point of view, the T-38 is much simpler in many ways than the T-33. Instruments and switches are more logically and conveniently located and many procedures have been greatly simplified. Examples of this are the normal airstart procedure which requires only two steps, and the emergency or "tiger" airstart which is accomplished in one step.

With the team of the T-37 primary trainer and the T-38 basic trainer, the student need conquer only one major problem at a time. In the T-37 he will master the rudiments of flying and the basic jet techniques and procedures. Since T-38 procedures are simple, the student can concentrate on adjusting to the high-performance characteristics of supersonic aircraft. This mental conditioning will produce the product that ATC is striving for, a pilot that is "high-performance oriented." For example, what happens when the awesome sound "barrier" is broken? Actually nothing happens in the T-38. The student pilot will not even know he is supersonic unless he looks at the mach indicator. This, then, is one of the problems which will not concern him when he checks out in a first-line aircraft.

There are other lessons to be learned in the supersonic range. The student will see how rapidly high g-forces, required for maximum performance turns, cause airspeed to bleed off into subsonic flight. In the formation training phase he will learn the necessity of precise control

T-33 vs. T-38 Basic Training Flying Hours

Present T-33	Flying phase	Proposed T-38
40:30	Contact flying	37:30
33:00	Instruments	33:30
19:00	Navigation	26:45
31:00	Formation	38:30
6:30	Optional time	3:45
130:00	total	140:00

movements while supersonic, since the controls are very sensitive. If he ventures too far forward from his normal wing position in formation, his aircraft will be shaken by the invisible shock wave being pushed ahead of the leader's plane. The supersonic dash to target, a combat technique developed for the latest bombers and fighter-bombers, will require careful pilotage navigation. No radio aids will be available, ground is covered rapidly, and the pilot cannot afford to miss a single check point.

One of the most important gains realized from T-38 training will be in high-altitude indoctrination. Although the aircraft is flying at a high true airspeed and high mach number, the indicated airspeed is quite low and is usually in the aircraft's marginal performance range. The pilot must avoid abrupt control movements or rapid attitude changes, either of which can cause a drop in airspeed. Any airspeed loss must be corrected immediately, since the aircraft is operating near stall speed. In addition to these problems, the pilot must pay special attention to his oxygen equipment and cockpit pressurization. Any malfunction must be corrected immediately because a pilot's "time of useful consciousness" without oxygen is very short at these high altitudes.

Initial indoctrination in high-altitude flying will be given in the transition phase, but in each phase of flying training certain missions will be devoted to showing the student the effects of high altitude on that particular type of flying. In the instrument phase the major problem is attitude control in the marginal airspeed range. This problem continues into formation flying and is compounded by slow aircraft response to power changes. High-altitude navigation is complicated by the very strong high-altitude winds and the continuous problem of

attitude control. The importance of this high-altitude indoctrination cannot be overemphasized. Both fighters and bombers are attaining very high cruising altitudes, and future manned vehicles will probe even deeper into space.

impact of the T-38 on first-line units

In 1962 the first-line units will begin to receive the T-37/T-38 trained pilot. What will the impact be? We believe these units will reap a great reward. The combat units will receive a man who is high-performance oriented, a pilot who is mentally conditioned to deal with high climb rates, high-altitude–true-airspeed navigation and formation, supersonic flight, and high-sink-rate landings. This will be true whether the graduate goes to a fighter or bomber unit, since both operate high-performance aircraft.

For example the T-38 will eliminate the requirement for the first-line units to teach their fledgling pilots about high sink rate. The student who trained in T-37's and T-33's is not prepared for this feature of high-performance combat aircraft. In the older trainers a stall is usually accompanied by big change in attitude -a dropping of the nose and a falling off on one wing. Recovery is simple; a slight nose-down attitude will "break" the stall. But in the T-38 and other high-performance aircraft a stall is predominantly an ever increasing rate of descent, not necessarily with much change in attitude. Recovery requires a large increase in power or a very steep nose-down attitude with an excessive loss in altitude. The student who flies the T-38 will learn that in landing he must make a flat, power-on approach, thus better preparing him for century-series aircraft.

It is true that the new graduate going to a first-line unit will have to familiarize himself with a highly complex new weapon system, but he will not have to attempt this while coping with a high-performance aircraft for the first time.

We believe that as a result of the new ATC pilot training program the first-line units will get a man who can become combat-ready in any weapon system with less training and with a higher degree of flying safety than has ever been possible before. This should reduce the units' training time, costs, and the number of two-seat combat-type aircraft that are required.

LET us summarize the over-all impact of the T-38 Talon as it enters the ATC inventory. Although the usual adjustments to the training program will be necessary, as with any new piece of equipment, the physical impact of the T-38 will not be too great. To the student pilot it means a logical and uniform progression from the rudiments of flying to the mastery of a high-performance jet.

The first-line units will receive a pilot who is already qualified in a

supersonic jet and is high-performance oriented. He should be combat-ready with less training and with a higher degree of flying safety.

Every pilot remembers his first reaction to a new airplane of greater performance than what he is accustomed to. A pilot stepping up to a higher-powered aircraft is generally filled with misgivings and doubts about his ability to master the new "bird." This has always been true, whether it was a step from a BT-13 to a T-6 in early World War II, or from a T-33 to a century-series fighter. Normally pilots will quickly adjust themselves to the change, and after a few flying hours the doubts are replaced by confidence and ever increasing proficiency.

The fact that Air Force students and pilots can make this upward step is a result of careful attention to the learning process in the Air Training Command and throughout the Air Force. The Training Command long ago recognized the importance of proper mental conditioning of its student pilots. The product of this awareness is the T-38 Talon, a trainer to bridge the gap.

Headquarters Air Training Command