

# STC: A Continuing Controversy

*Well known by designation but little understood in concept, FAA's supplemental type certificate system appears headed for overhaul. AOPA invited its proponents and opponents to sound off, with the interesting results*

A term with which most pilots are vaguely familiar but which few seem to really understand provides a source of continuing controversy within the general aviation industry. Just the mention of "STC" is enough to conjure up mental images within aeronautical minds of a montage of mixed blessings and sins.

Advocates of the STC see it as the salvation of flying and the advancement of aircraft technology. Opponents appear to regard it as regulatory sanction for contamination of the pure aeronautical product. The result is that the STC, since its inception in 1955, has been a "storm center," cleaving the solidarity of the industry.

The term, STC, stands for "supplemental type certificate," but its clear definition is not quite that simple.

Part 21 of the Federal Aviation Regulations provides for issuance by FAA of supplemental type certificates to persons who make major changes to a previously approved, or type-certificated, aircraft. In order to receive an STC, the aircraft modifier must submit to FAA for evaluation detailed engineering data to show how the change will affect the airworthiness of the previously approved plane, whether the level of safety will be increased or decreased, how it will affect the aircraft's original performance, and how the modification will perform its intended function or purpose. After an STC is issued for a particular change, other persons may make the same modification to the same type of aircraft, provided it is done in accordance with engineering data approved by FAA.

Again—usually in the case of less complicated, one-time modifications on a particular aircraft, not intended for multiple production—an STC may require submission of little or no technical data and merely a visual inspection by an FAA engineer to win approval.

That sounds elementary enough—until you delve into it and start to try to find answers to the questions: What constitutes a "major change" in an aircraft? When must engineering data be submitted to FAA and when can a change be STC'd by a field engineer? How do you know whether a particular modification has been previously made that will help to cut engineering and

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Up For Early DOT Passage**

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work costs? How long does it take to get an STC? What must or must not be done before application for STC is made?

Similar questions could pile up interminably and so could the bureaucratic red tape, in the opinions of many STC seekers. In fact, it has in some cases. So much so that in recent months there has been a growing movement among many of the companies that make their living off STC's to have some of the weight of governmental paperwork removed. On the other hand, some manufacturers of type-certificated aircraft have complained bitterly that FAA is too liberal in its bestowal of STC's that tend to degrade their products.

With the growing complexity of today's aircraft and the consequently increasing number of areas in which modification of a particular airframe or its power source becomes possible, the number of STC's applied for and issued has grown by great strides. As of last November, FAA's Summary of Supplemental Type Certificates contained 4,583 STC's that had been issued on type-certificated aeronautical products of 93 manufacturers. And that document covered only STC's which the owners had indicated would be made available to others.

Since the STC system was inaugurated in 1955, it is estimated conservatively that at least 10,000 such STC's have been issued, discounting the thousands of others of a "one shot" nature that did not require flight testing or the submission of extensive technical data.

Strictly speaking, the STC is required to insure that any modifications or changes made to the structure, weight and balance, or performance of a previously type-certificated aircraft design will not impair that design or derogate safety. Virtually any change, therefore, from the installation of a radio to anything short of changes that require completely new type certifica-

tion, would technically fall within the scope of the STC system.

Until 1955, the Civil Aeronautics Administration authorized the performance of extensive aircraft modifications under its alteration and repair system. Under this, A&P authorized inspectors could in many cases confirm that the modifications resulted in no compromise of the plane's airworthiness and no further approval was required.

As modifications took on an increasingly complex nature, however—with the adaptation of two engines to single-engine planes, the shortening of fuselages and lengthening of wings, etc.—airframe manufacturers claimed their craft were being made unsafe and the reflection was not on the modifier but on the original workmanship.

CAA responded with the STC system. Originally intended to cover only those gross structural changes which caused concern for safety, the system spread amorphaously, its tentacles extending so deeply into every aspect of airframe and powerplant work that not only mechanics but FAA inspectors apparently became confused over what should and what should not require STC processing. The general guideline seemed to be "when in doubt, STC it."

The purpose of the STC system, according to William H. Weeks, head of FAA's Manufacturing and Engineering Division, is safety, pure and simple. It exists merely to insure that any changes made to an aircraft will comply with existing FAR's covering safety, airworthiness and basic certification standards, he said.

But with increasing numbers and complexity of modern-day aircraft, there has been a corresponding expansion of regulations that have to be complied with. The STC task has therefore become a heavy burden for the agency, the STC applicant, the A&P and the plane owner.

FAA sought to relieve some of that burden last fall when it revised FAR Part 21 to delegate STC approval to certain designated alteration stations. Under the change, this delegation of authority would be extended to manufacturers, air carrier or commercial operators and some certificated repair stations. That delegation would give



## Leading STC Holders

The full extent of the general aviation STC industry in the United States is difficult to determine, due to the number of modifiers who work in the name of individual aircraft owners, those who perform "one time" modifications and because of other complications. An indication of the significance of STC may be gained, however, by this partial list of companies that engage in aircraft modification as a major interest. Again, the specialty or specialties indicated do not necessarily describe the full range of those companies' services.

Company	Major Specialty
Allison Div. of General Motors Corp.	Conversion of Convair 340/440 to turboprop
American Airmotive Corp.	Conversion of Stearman 75 to ag-plane
Brittain Industries, Inc.	Manufacture and installation of tip tanks, autopilots
Carson Helicopters, Inc.	Modifications to improve performance and payload of light helicopters
Dallas Aero Service	Engine and interior modifications
Downer Aircraft Co., Inc.	Modification kits for Republic <i>Seabee</i>
Doyn Aircraft, Inc.	Engine modifications
The Dumod Corp.	Modernization of Beechcraft 18
Hamilton Aircraft Co., Inc.	Conversion of North American T-28A
Business Aircraft Corp.	Modification of engines and airframes, conversion of Beechcraft <i>Travelair</i> to three-engine transport
International Aircraft Deliveries, Inc.	Modification of Beechcraft C-45
Lockheed Aircraft Service Co.	Conversion of <i>Constellation</i> , <i>Super Constellation</i> and Douglas DC-7
McKinnon Enterprises, Inc.	Airframe and engine conversions of Grumman <i>Widgeon</i> and <i>Goose</i>
On Mark Engineering Co.	Conversion of Douglas B-26
Pacific Airmotive Corp.	Conversion of airframe and engine, various models
Rhodes Berry Co.	Conversion of Douglas B-26
Riley Aeronautics Corp.	Conversion of airframes and engines
Riley Aeronautics Corp.	Engine conversions
L. B. Smith Aircraft Corp.	Airframe and engine conversions
Steward Davis, Inc.	"Jet packet" engine conversions of Fairchild C-82, C-119
Trans-Florida Aviation, Inc.	Tandem two-seat conversion of North American F-51
Transland Aircraft	Ag and special purpose conversions
Volpar, Inc.	Tri-gear conversion of Beechcraft 18
Wren Aircraft Corp.	Conversion of Cessna 182

fication agencies for aircraft changes which have been poorly conceived, poorly manufactured, and which do not improve the utility or safety of the aircraft. Likewise, there have been cases where manufacturers have received type certificates on aircraft that do not really measure up to FAA standards, he said.

"What I believe the controversy boils down to is that the FAA needs to be more diligent in requiring the applicant for certification of an aircraft, whether it be type certificate or STC, to meet exactly the same requirements and the same interpretation of the regulations, regardless of his FAA region, his size, or his status in the industry . . . it behooves the original manufacturer to take care to see that he does not abuse his delegated option privilege by approving systems that FAA would not accept and it behooves the producer of an STC to make certain that his modification is of high quality and does advance the usefulness of the aircraft and is not only a gadget to sell and make a profit with."

That respondent voiced the opinion that it would be presumptuous of either a government agency, an individual or an airframe manufacturer to feel that an airplane, during its life span, will never have a requirement to be modified to make it more suitable for the owner's use. The ability to obtain an STC gives the owner or operator the leeway to use his plane for specialized jobs if necessary. There are many cases when an otherwise obsolete plane, by applying modern techniques and powerplants, can be made to have an extended useful life and be competitive with new production aircraft at considerably less cost, he said.

"It would seem to me that all of the services that provide either a more desirable aircraft or extend its useful life are certainly services performed in the best interest of the public," he declared.

Another supporter of the STC advocates turning the issuance of supplements over to industry on a basis equivalent to underwriter laboratories. Under the present system, he claimed, his organization has experienced excessive waste of time and money in obtaining STC's because of "the problem of FAA considering the Aerospace Industries Association as the voice of industry with respect to STC's, whereas AIA is controlled by members who would like to do away with STC's, or at least make them as difficult as possible to obtain." It is high time, in that respondent's opinion, for the pro-STC forces to organize to make their contributions and desires as well known as the people they regard as their opponents have done.

At least one STC holder is strongly opposed to FAA's method of handling STC's. Claiming that bureaucratic delay had cost him more than \$25,000 and a year in time for approval of one particular STC item, he accused the system of hampering technological advancement.

those so approved the authority to determine that STC's did comply with all applicable regulations, thus lightening the volume of work of FAA inspector-engineers.

The change drew mixed reactions from the industry. To explore more deeply the entire STC picture, AOPA solicited comments both pro and con from several STC holders and manufacturers. Here is the essence of those comments:

According to one proponent of STC's, the greatest part of the controversy surrounding more liberal application of the system is the argument advanced

by airframe manufacturers that the people who obtain STC's are not required to maintain as high a level of safety or excellence in product design as the original manufacturer. The latter is therefore concerned that his product's reputation may suffer from improper modification. On the other hand, many people who obtain STC's argue with equal vigor and conviction that most of the prime manufacturers certify their own aircraft and they are really not FAA-approved at all.

There is merit on both sides of the argument, in that respondent's opinion. There have been STC's issued to modi-



"FAA regulations with regard to technical items is a matter of scientific fact plus interpretation and there is no court of appeals to review an incorrect judgment," he declared. "I propose that a technical review board or boards (for powerplants, structures, etc.) be set up so people like ourselves would have some recourse when a technically wrong FAA decision hampers progress. . . . The cost of supporting such review boards or underwriter laboratories is very small compared to the money now spent by industry as well as FAA personnel in obtaining unneeded data and red tape."

Another sees FAA's method of handling the STC system as the most logical safeguard for the aviation industry and the well-being of pilots and passengers. He views FAA's role as a monitorship rather than authoritarian control, and stated that the agency has been most cooperative and helpful in providing guidance for procurement of the 109 STC's his company holds.

The major benefit of the STC system as it exists, in his opinion, is that it enforces a subjective analysis of a type-certificated aircraft in relation to its proposed modification. Therefore, it doubly insures the airworthiness of the plane in its modified configuration.

Contrary to the complaint voiced by some other respondents, this STC holder does not believe the system is overly complicated. The greatest difficulty and the primary difference between the STC and the type certificate is that the STC holder does not have the verifying data available for structural changes that the manufacturer has. But this in itself works to the plane owner's advantage, he believes, because the modifications therefore have to be proved out by FAA evaluation and flight tests.

"The weakest point in the STC program," he said, "would probably lie in those isolated instances where the same interpretation of STC requirements is not applied by all FAA Regions. Once an STC is issued in one Region, it must be recognized in all Regions unless in a subsequent application it is found to constitute a substantial hazard or compromise of airworthiness." There have been enough instances to draw notice of STC's being issued within one Region that would have proved totally unacceptable to the field engineers in another Region, he disclosed.

That same STC holder said he believes there would be a lot less resentment of the STC system by airframe manufacturers and less controversy and red tape surrounding it if more STC applicants would adopt his method of operation. Before embarking on an STC project, he tries to get together with FAA engineers—and if possible, manufacturer's representatives—to discuss the purpose and potential benefits of a modification that is planned for more than one application. "FAA in particular can be of great help by being brought into discussions early," he said. "The experience of FAA engineers enables us to point up those areas where the greatest problems lie, thus enhanc-

ing our engineering efforts and keeping expenses down."

He agrees with many of the airframe manufacturers that once a plane has been STC'd, no responsibility for it whatsoever should be attached to the original manufacturer. "The type-certificated aircraft is designed to do certain things in a certain manner," he declared. "Any modification that would cause it to perform in any way differently from that contained in the manufacturer's flight manual therefore takes it out of his realm of responsibility."

According to another STC holder, a great deal of resentment toward STC's seems to spring from among manufacturers because they feel the STC holder does not have the technical expertise the manufacturer possesses; that he may design an unsafe or unserviceable conversion that is detrimental to the original design and will reflect unfavorably on all of the manufacturer's products.

This is not so, the STC holder claims. "FAA not only requires the same performance, safety and quality in the converted plane as was required at the time of TC, but requires the modifier in most cases to exceed and even correct some deficiencies in the original design."

In his opinion, some of the most vital advances in the industry have come about through STC. "Every aircraft on today's market is a compromise of all major requirements, such as useful load, takeoff and landing characteristics, slow- and high-speed flight capabilities, etc. We can't have all, so the designer sacrifices a little on all. STC's meet a special need for individual aircraft owners by filling the gap left by the manufacturer's compromises. This need is filled as a profitable enterprise by the modifiers, whereas disruption of an assembly line to install such modifications would be prohibitive in cost."

On the other hand, some airframe manufacturers offer what they feel are logical arguments against any liberalization of STC procedures. Said one, "The original idea of the STC had merit, but in this manufacturer's opinion it is being misused and now is con-

ductive to dual standards of certification for aircraft. It is now possible to develop complete and different aircraft by the STC system from an airframe which was carefully designed and supervised by the FAA. In many cases, the resultant new aircraft possess many features that the original certifier would not have been given approval for by FAA.

"Much of the modification work is done without the benefit of, or supposedly access to, type-certificate data. Those of us in the aircraft manufacturing business call upon all our data and resources to develop new aircraft. In addition, modifications approved by the STC method are often inferior and not in compliance with the same design produced in another region and regulated out of business as being unacceptable by FAA.

"It is our opinion that the STC should be revamped to include only accessory minor modifications and leave the aircraft development work to the qualified manufacturers. Also, the FAA should get out of the aircraft consulting business for the STC clan."

In a less vitriolic vein, another manufacturer disclosed some strong opinions both in favor of and against the STC. He voiced the opinion that anyone should have the right to modify any article that he owns. "Even though a manufacturer may disagree completely with a modification which is made . . . there can be cases . . . with a resulting improvement in the state of the art of a given plane. There have been examples of this, such as the tricycle gear installation on the Beechcraft Model 18, that were subsequently adopted by a manufacturer and placed in production.

"There is a definite difference of opinion about the airworthiness of such installations [as engines not offered by the manufacturer] and none of the aircraft manufacturers have ever gone into production on these engine installations . . . Many times the manufacturer does not find it practical or expedient to introduce such types of variation in his own production, even though there may be some limited de-

#### STC's Available For Duplication

Original Aircraft Manufacturer	Number STC's Issued	Number Models Affected
Aero Commander	147	5
Alon	42	2
Beech	804	10
Cessna	463	20
Champion	46	1
Mooney	40	2
Piper	433	21

Included here are numbers of STC's issued on products of current leading general aviation aircraft manufacturers that are listed in FAA's Summary of Supplemental Type Certificates. These represent only a few of the 4,583 STC's on products of 93 manufacturers that are available for duplication



mand in the field. I believe the freedom of an individual in being able to make such installations on a type-certificated article should be protected and honored by FAA.

"There are certain ground rules, however, that need to be improved . . . For example, when [a major] installation has been made . . . this airplane should no longer be identified as a type-certificated product of the original manufacturer. It no longer complies with all the TC data which the manufacturer is compelled to assemble in order to obtain a type certificate.

"We believe that an aircraft which has been so modified is no longer the responsibility of the company and that all maintenance problems, arising from whatever source, now become the responsibility of the airplane modifier. Under the present FAA system this is not always possible. . . . Such aircraft are still listed under the manufacturer's name and are identified by the original aircraft serial number. To the owner in the field and to FAA it is still the original manufacturer's product. It is this part of the system that is most objectionable to us.

"From our limited knowledge of the subject we have no information that would show that there is any actual deterioration in aircraft safety resulting from the STC system . . . We do know and have examples of cases where the aircraft modifier has not had to meet the strict interpretation of the many FAA requirements that the manufacturer, through long years of experience, has been forced to adopt. Some of our efforts therefore have been directed toward FAA to obtain a more uniform enforcement of the regulations on field modifications. That is, we want the same rules for certification applied to the modifier that are applied to the original manufacturer."

Another manufacturer claims to take no position for or against STC, but "Our concern is over the possible conflict when a number of modifications, not tested together prior to installation, are put in one aircraft," he claimed.

"The tremendous variety of STC's leads to confusion," he said. "At the end of 1965, FAA records showed that the agency had issued a total of 433 STC's on various models of Piper aircraft alone. These range from simple installations such as a compass bracket to major structural and engine changes.

"Some say the basic argument is that FAA is not equipped to exercise strict control over STC developers in all cases and that STC developers take proprietary material on which the manufacturer has spent much development time and money. Service life of the aircraft, the manufacturer's responsibility and the possible conflict between several STC modifications on the same aircraft are possibly the most controversial areas. On the other hand, every manufacturer uses STC'd items in production when the situation warrants.

"There is an argument that when a particular model is extensively modified, the original manufacturer's name

should come off and that of the STC holder go on the aircraft. We feel, in some instances, that this is a justifiable attitude. The public is not acquainted with the STC system. It recognizes, generally, only the name of the manufacturer. . . . Since our name is one of our most valuable assets, we feel we have the right to take steps to protect it.

"This situation can be avoided if FAA would evaluate the STC's on each aircraft in aggregate and publish information on any dangerous or undesirable conditions which could arise from several different STC modifications on the same aircraft. . . . There is a place for the STC in general aviation. As long as modifications and new equipment are properly engineered, tested and evaluated in accordance with FAA regulations . . . it presents no problem."

Perhaps the most critical comment received from a manufacturer concerning STC related not to the work of the STC holders but to the system itself. The manufacturer finds himself in an unfair position as a result of regulations governing modifications to aircraft after initial FAA airworthiness certification, he claimed.

"Once an airplane leaves the factory . . . future modifications to it many times are not adequately reviewed by informed FAA engineering personnel. The decision as to whether or not FAA engineering airworthiness evaluation and approval are necessary is the prerogative of the FAA inspector . . . Accomplishment of FAA Form 337, 'Major Repair and Alteration,' prior to an after the fact audit by FAA engineering is many times sufficient for return to service under these conditions. We do not consider operations such as this will insure maintenance of the original airworthiness level of safety," he said.

"Because of the many contingencies existing relevant to aircraft type certification, we cannot believe the STC system or the current rules governing modifications adequately insure continuance of an airworthiness level in the aircraft on par with that established during original type certification."

He voiced the opinion that the modifier ordinarily is not willing or able to spend the money required to provide the thoroughness necessary to maintenance of airworthiness, that only the manufacturer could have the data and know-how for strict compliance with regulatory requirements, and that there can be no uniform level of STC safety standards when interpretation of the regulations varies from one Region to another.

"STC's issued against aircraft receiving type certification under FAR Part 25 . . . are issued, to a certain degree, at the expense of the TC holder," he claimed. "Under the guise of economy, FAA personnel are always free to use knowledge gained from type certification and review of the aircraft manufacturer's data.

"The unfavorable position the aircraft manufacturer finds himself in is

easily apparent when an accident occurs," he added. "In all of the suits against us, we have yet to have an STC holder named also in the suit."

He suggested that, "In the interest of safety, modifications of STC proportions should be required to have manufacturer acceptance as a condition for FAA approval, or major modifications to aircraft should be restricted to the manufacturer."

As far as FAA is concerned, the STC system plays a vital role in aviation today. It allows the aircraft owner or operator to add the niceties and necessities that make the plane most useful and attractive to him as an individual. Under their mass production or broad market techniques, manufacturers are unable to do this.

The STC system is necessary, according to FAA's Weeks, because it provides an orderly process to accomplish what the law requires in maintaining engineering standards and aviation safety. It also serves to promote the growth of general aviation, in his opinion, because it helps to broaden the parameters of utility and performance for a particular plane.

One advantage of the present system of processing and recording STC's, he said, is that it puts the data and problems of previous modifications at the disposal of anyone contemplating similar aircraft changes, thus reducing engineering time and costs.

Even so, FAA is looking for ways to simplify the problems of the STC procedure, both in bulk and complexity. Several rules projects are now in process within the agency to bring the concept of STC back to its original intent—that of applying to major modifications only, with minor modifications being carried out under repair and alteration procedures.

To this end, one document already has been published and several others are in the works. Identified as Advisory Circular 43.13-2, *Acceptable Methods, Techniques And Practices, Aircraft Alterations*, the document contains standards and guidelines that are acceptable to FAA for minor aircraft modifications. Hopefully, if the local A&P who performs the work follows these standards, an authorized inspector may sign off on the work, negating the need for the time and expense involved in STC.

According to George H. Weitz, chief of FAA's Maintenance Division, the proposed return swing of the regulatory pendulum may afford the opportunity for even greater advances in aviation technology. With the weight of the more minor STC's off their backs, engineers may be encouraged to experiment in the use of new methods and materials for aircraft fabrication.

Although the STC system as it exists has obvious faults, it does provide one point of common agreement among the various parties concerned. It serves to insure that everyone and his brother does not build or hang onto an aircraft various and sundry items that derogate safety and good sense. ●