Authority And Command

The proper roles of the pilot-in-command and ATC are often blurred, especially in congested airspace.

By Wally Roberts

THE CRASH OF AN AMERICAN Airlines Boeing 757 during descent and approach to Cali, Colombia in December, 1995 was the result of the flight crew's misunderstanding of its and ATC's role in the proper conduct of an instrument approach procedure (see "Cascading Events," July *IFRR*). The crew was having a problem programming the last-minute IAP into the B-757's "glass" cockpit area navigation system and sought the help of ATC to bypass the critical segments of the IAP. The crew almost certainly thought ATC could wave its magic wand, thus negating the critical early segments of this mountain-laden IAP.

Had this flight crew fully understood the traditional relationship between ATC, the pilot-in-command, and the IAP itself, this accident wouldn't have happened. This flight crew wasn't comprised of a couple of dummies, rather they were the prevalent end-product of what could fairly be called an aberrant U.S. ATC system and U.S. instrument pilot training environment.

ATC's fundamental purpose

Air traffic services throughout the world exist for one fundamental purpose: *to ensure adequate and safe separation between IFR aircraft within controlled airspace.* There are three significant secondary functions of ATC: (1) provide airport and runway services to all aircraft at airports with operating control towers, (2) route IFR aircraft to avoid controlled airspace that is restricted or unusable because of military or other special operations, and (3) provide pertinent information that will assist the pilot—such as traffic information, significant weather advisories, and other safety-related information deemed appropriate by ATC policy makers.

An extension of secondary function (1) is the limited separation and sequencing of VFR aircraft in the terminal airspace that surrounds high-density (high-collision-risk) airports, which we know as Class B and C airspace.

Single airplane example

A good example that sets forth the fundamental of the relationship between ATC and the IFR aircraft is to hypothesize there is only one airplane flying IFR anywhere in the U.S. In this admittedly extreme example would there be any need for ATC at all? Not really, provided someone was available to help with timely weather information. The pilot would be free to use any published route and fly to the airport of choice. The pilot could also elect to forego published routes provided he/she maintained at least the minimum en route IFR altitude set forth by FAR 91.177(a)(2). Once at the destination, descent below the minimum legal IFR en route altitude would be made via any published and available IAP, but the pilot wouldn't be free to shortcut any required segments of the IAP while operating under IFR.

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The "single airplane" example is extreme, but it demonstrates the point that the IFR pilot, not ATC, owns the sky when traffic is not a factor. Let's modify our hypothesis and say it's 3:00 a.m. and there are several airplanes widely separated within 300 miles of airspace. It's still pretty much the pilot's call, with ATC approving pilot requests while making certain no conflict will develop with either the widely scattered IFR traffic or restricted airspace.

Efficiency in the face of traffic

The foregoing principles apply to all of the controlled airspace of the world and is fairly well set forth in applicable United Nation International Civil Aviation (ICAO) agreements. The genesis for these concepts was originated by the early United States commercial air carrier operations of the 1920s and 1930s. In those early days, the airlines ran the air traffic control system in this country.

As aviation commerce grew the government saw its way to take over both the rules and operation of ATC. Government saw a compelling interest in moving the maximum amount of IFR traffic within the constraints of the existing systems. Thus evolved the constraints imposed by several IFR pilots wanting their way and needing a referee to balance the needs of each pilot against the entire group airborne (as well as those chomping to become airborne) at any given time.

The fundamental ATC system evolved prior to the advent of radar. Separation was based on time/altitude/distance standards applied on the basis of pilot position reports and filed true airspeed, with the pilots communicating with ATC through en route communications relay stations. In most of the world's airspace this rudimentary system is still the order of the day, often with ATC communications being made through intermediaries. In some parts of the world, there are domestic ATC systems that have radar in spots, with the voids not always being apparent to the pilot. (This is even true of the U.S. today at lower altitudes, particularly in the high mountain country.)

Necessity and mother's invention

The development of radar was born of pre-World War II necessity. Lurking

close in the background was the dream of congested airspace air traffic managers to have real-time surveillance of IFR traffic, at least in busy terminal airspace.

We all know the rest of the story...or do we? Here is where the waters got muddied, in the interests of the safe, expeditious, and efficient movement of IFR traffic in high-density airspace. With the advent of radar, the controller became proactive rather than reactive. What used to be huge parcels of airspace that had to be partitioned for time/altitude/distance separation immediately became chopped into relatively infinitesimal pieces. For the first time, the available concrete at the busy airports became the limiting factor for traffic acceptance rates rather than available en route and terminal airspace.

Radar placed controllers into the position of being able to micro-manage separation and efficient movement of IFR traffic by adjusting aircraft speed and flight paths on the fly. Pilots, as well as "the system," were apparent beneficiaries of this ATC eye-in-the-sky. Who doesn't appreciate, *"turn left heading 060, proceed direct Skygirl VOR when able."* Or, *"descend to 3,000, fly heading of 240 for a vector to the Skylawn Runway 24 ILS final approach course."*

Potentially deadly illusion

As ATC radar evolved and matured, both pilots and controllers became so used to it that the *appearance* the controller was really flying the airplane came into not only the lore of the land, but even into the lore of the aviation community. Good controllers soon learned how to milk the maximum out of the system through usually judicious and expert use of their radar scopes.

But, from the outset, there have been limits to what a controller can, and cannot, do with radar separation techniques and procedures. That's a key point to keep in mind: they are radar *separation* techniques and procedures. They are *not* replacements for the pilot's primary responsibility for both control and navigation of the aircraft. This profound principle is so easily lost in the "noise" of constant ATC communications and radar instructions, from pre-taxi clearance contacts until engine shutdown.

Any instrument flight instructor worth the job description has instilled in his/her students from day-one the critical principles of flying IFR, especially single-pilot IFR, in decreasing order of importance: (1) aviate, (2) navigate, and (3) communicate. Yet, the pressures of the system seem to drive (3) into at least a tie with (1).

What's worse is that neither the pilot nor the controller typically fully understand the capabilities and limitations of each other. ATC procedures are a hodgepodge of years of collections of time-tested techniques, procedures, and legal imperatives, sometimes with an eye to squeeze a bit more "efficiency" out of the system. The result is a complex handbook that is difficult for controllers to fully understand, and effectively impossible for most pilots to fully comprehend.

Job descriptions very different

Pilots are trained to fly airplanes. In the case of instrument-rated pilots, this extends to being able to safely and competently control and navigate the aircraft

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solely by reference to instruments and avionics. The instrument-rated pilot is also expected to have sufficient understanding of the ATC system so as to be able to comply with an IFR flight plan and all reasonable ATC clearances and instructions.

The properly trained IFR domestic airspace controller is required to be proficient in the use of radar separation techniques and procedures, and to be very familiar with the layout, constraints and limitations of the ATC facility's airspace. Most Center controllers that work low-altitude sectors also get some fairly intensive training in non-radar separation procedures for the many pockets of non-radar terminal airspace.

This gets me to the ever-sensitive issue between pilots and controllers: the job description of ATC controllers doesn't include knowing how to fly an airplane. Most controllers these days aren't pilots. Those controllers who are also pilots carry to their job a real plus. Nonetheless, it's not a part of the job description, contrary to the many Hollywood films that have the controller saving the day when the pilot passes out or succumbs to a heart attack. Of course there have been some wonderful real-world situations where controllers who happened to also be pilots have made some remarkable saves, well above and beyond the call of duty, but it's neither to be expected nor counted on.

Terminal instrument procedures

I can't say often enough how demanding the training and skills that are required of a proficient radar controller. Nonetheless, they are skills directed towards that safe and efficient separation of IFR airplanes. The navigation services that a pilot should expect from ATC are finite and limited, even in a radar environment. Controllers are well-trained in the use of radar, and its relationship to the en route structure. Their training on instrument approach procedures, however, is limited to the nature of the IAP's routes, and the ability to use radar to shortcut segments leading to the FAF, *where local conditions permit.*

Nor are controllers trained on the pilot/aircraft performance and obstacle-clearance aspects of IFR departure procedures and SIDs. The controller's perspective is limited to the routes these procedures follow as they relate to traf-

fic separation. Traffic separation is the controller's game. Obstacle clearance and adherence to the system/aircraft performance limitations of IAPs and departure procedures is the pilot's game. Alas, these lines, too, get blurred at many locations where the controller can provide radar-vectored departure assistance to the en route structure.

The wary pilot who knows all these nuances is well-served by the time-saving departure vector, yet not lulled at a mountain bowl airport with little or no effective ATC radar coverage. A more general principle about all radar vectors: *if there is an iota of doubt in your mind that it is a radar vector, with its attendant sharing by ATC in terrain clearance responsibilities, don't accept it without some serious questions.*[1]

Controller provided approach

There is also the special case where some ATC terminal facilities can provide ASR (or even rarer these days) PAR approaches. These are truly hybrid IAPs that come the closest to giving the appearance that the skilled controller is flying the airplane. Think about it, though: the ASR and PAR IAPs are advanced forms of controller-provided navigation. Also, these are services that are best used only after a recent fair-weather practice session for both the pilot and the controller.

No denigration here

In my career of flying mostly domestic U.S. airline routes I cannot remember how many times ATC has offered additional services, such as advance warning on severe lines of thunderstorms, or information on turbulence, or even a friendly, casual comment about a football game. The controller is a valuable partner when it is all working as it's suppose to. When it's working at its best, the controller provides not only that essential separation service, the additional services are replete.

When to draw the line

The pilot must be ever diligent about when to draw the line as to what the controller is permitted to do in navigation of the aircraft for sake of system efficiency. The American Airlines tragedy at Cali demonstrated a flight crew that had unreasonable expectations about what a non-radar controller could, or could not, do to change terminal instrument procedures. In this case the controller, in the face of a language limitation, tried several times to keep the crew on the full IAP.

The American Airlines crew had undoubtedly been conditioned by the innumerable times U.S. ATC had, for instance, taken it off a SID or STAR with a vector, followed by a return-to-course and "resume own nav." Or, perhaps the crew had been "saved" by ATC over the years by a simple reroute to save having to resolve a complex glass cockpit routing-construction problem.

Without careful reflection upon the limitations of ATC's role, it's easy to have all this high-density airspace ATC intervention cause the potentially dangerous appearance that controllers are omnipotent soothsayers of all instrument flight procedures. The soothsayers reside in IAP design offices and technical users groups. They aren't available by picking up the mic.

It's up to the pilot to faithfully follow all published procedures, excepting only those vectored or "direct" shortcuts that are consistent with the published procedure, whether it be a SID, airway, or IAP (IFR departure procedures never can have ATC shortcuts). *It's strictly up to you, the pilot, to know what is correct and incorrect about the use of airways, departure, and instrument approach procedures, and that's no simple task.*

Pilot knowledge and cooperation

The ATC system works best when pilots and controllers cooperate with each other. When safety is obviously not at stake, pilots are well advised to go with the flow, and not be overly concerned about what appears to be a slightly inefficient clearance or instruction from ATC. The more confident you are about your responsibilities vis-à-vis the controller's, the easier it is to defer to the controller when safety isn't a factor. Take it with a smile and consider it money in the bank for that rainy day when you have to fully exert your command authority to its fullest. In any case it's never worth angry words on the air. When you see something going astray, it's far better to be friendly and interestingly inquisitive, rather than combative and superior in attitude. Bad attitudes are bad attitudes, whether from pilots or controllers.

If you feel a need to argue save it for a phone call or, if something really serious needs to be resolved, say it in writing. If you believe there's an immediate safety issue involved take command of the situation objectively and without bluster. In critical situations declaring an emergency sooner, rather than later, often bodes well for both the pilot and the controller, assuming all bases are covered.

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If you feel uncomfortable about your technical command of the operational nuances of instrument flight procedures, you aren't alone. More training and information is needed in this arena. The FAA could do a better job of keeping pilots fully abreast of all the technical information needed by pilots. Airline and general aviation flight training departments could do a better job as well.—Ed.

[1] In the U.S., ATC assumes responsibility for issuing off-route altitudes that assure safe terrain clearance, anytime ***ATC initiates*** an off-route clearance. U.S. ATC also assumes responsibility for terrain clearance during radar vectors, except where the aircraft is climbing below the minimum vectoring altitude. In the rest of the world, ATC does not reliably assume responsibility for off-route terrain clearance, even where initiated by ATC. Some countries do not assume responsibility for terrain clearance even during radar vectors. Even U.S. ATC is not infallible so the off-route/radar vector terrain clearance responsibilities are, in fact, shared between the pilot and controller.