

INTRO TO NEXT GEN IFR

If everything works as the FAA promises, ADS-B and data link technology will increase the level of IFR safety while allowing more aircraft into the system. Here's what it will mean to you.

by Fred Simonds

General aviation IFR has changed very little since VORs emerged in the late 1950s. Now GPS and digital weather products are harbingers of even bigger changes to come. Here's a preview of what you can expect, and how IFR is evolving.

To set the stage, step forward to the year 2018. The Next Generation Air Traffic System inaugurated in 2006 and since renamed NextGen is now about half way through its implementation.

In 2010 the FAA mandated equipping aircraft with ADS-B "Out" by

TECHNOLOGY

2020 in order to operate in Class A, B, C and E airspace above 10,000 feet MSL. ADS-B "Out" means that an aircraft broadcasts information, such as its GPS-derived location, out to ground stations and to other aircraft, allowing controllers to separate traffic. Your aircraft is so equipped, at a cost of about \$8,000.

Preflight

First, you'll learn everything you need to know about the airspace you expect to use from one free authoritative source – with NextGen you always see exactly the same information the FAA sees. This includes limitations due to current or forecast weather, projected congestion, TFRs, active MOAs, and the like. Knowing your route of flight, you'll be told of non-functioning nav aids, RAIM and FDE predictions and even closed runways and blocked taxiways at your destination.

As you flight plan on your computer, a flight path agreement of your intent is developed. Dynamic in nature, the agreement is updated with both tactical and strategic infor-

mation to accommodate your preferences and optimize airspace resources. In the end, your briefing fully evaluates current and potential limitations along your intended route, meeting FAR §91.103 more thoroughly than its framers could ever imagine. You accept the agreement as negotiated.

Being dynamic, you'll receive automatic updates should conditions change along the proposed flight path from the time the agreement is built until the flight plan is closed. Knowing your intentions allows the FAA to anticipate your resource needs, making it more likely that you will get what you want, and helps the FAA better manage the airspace system overall.

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INSIDE INFO

3 Reality 101 — When you're VFR and the weather is closing in, it's time for pop-up IFR.

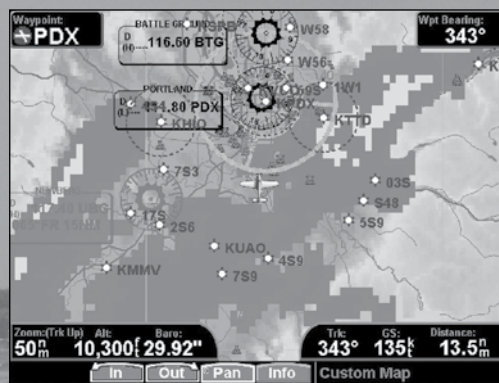
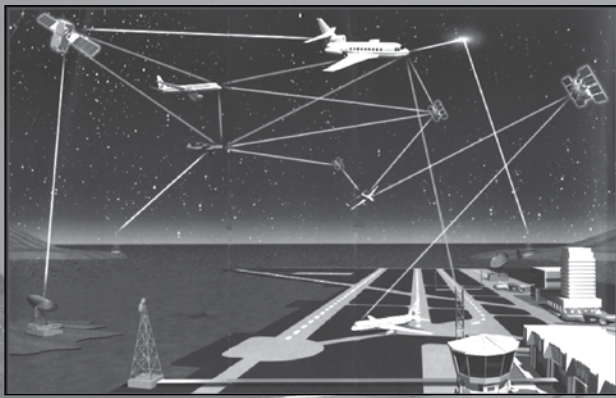
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13 Keeping Current — Getting your rating was a big deal; it's worth keeping current.

Data link will allow rapid flight path modification as needed for weather conditions and traffic.





By 2018, if the FAA's plan gels, ADS-B "Out" will allow startup to shutdown coordination between the pilot and ATC to enhance aircraft separation, system capacity and safety while keeping the pilot better informed about weather, location of other aircraft and airport conditions. The system will be heavily satellite and datalink dependent, upper left photo. ADS-B already allows in-cockpit presentation of nearby traffic, lower photo, and datalink weather in areas with ADS-B coverage, upper right photo.

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Departure

In 2018 you can access your final flight path agreement before beginning the flight on your computer or on the display in the aircraft. No more being blind-sided by last-minute routings that you have little choice but to accept or are forced to modify in-flight. Now you know what ATC has in store for you and can negotiate further changes if necessary before engine start.

At a towered airport, your flight deck display shows aircraft movement on your MFD denoting your position as well as that of other aircraft and vehicles in the vicinity. These displays help prevent runway incursions and other potential on-ground conflicts.

Additionally, controllers have Surface Traffic Management to auto-

mate taxi routing and manage taxiways, runways and aircraft movement more efficiently. ADS-B and Airport Surface Detection Equipment help locate aircraft to aid situational awareness and warn of possible conflicts. Data link MFD text messages reduce radio calls and confusion.

SIDs have evolved into RNAV SIDs, incorporating multiple precise departure paths from each runway end. You'll have your own path, keeping you safely separated from other aircraft and their wake vortices. Multiple paths help aircraft circumnavigate thunderstorms and other severe weather near the airport, and reduce noise.

Climb and Cruise

Climbing toward en route airspace, your ADS-B system reports your precise position to controllers via data link, allowing safe reduced separation

standards up to near top-of-climb. Since ADS-B shows you and ATC the same traffic, you see the position of other aircraft and climb efficiently with minimal maneuvering to join en route traffic flows. Indeed, ATC may assign spacing responsibility to you as you climb to cruising altitude.

The above-mentioned ADS-B air/ground data link operates at 1.04 megabits per second, a rate comparable to terrestrial DSL. Through this two-way link, routine and strategic information flows to you and automates certain routine tasks for both you and the controller. Controllers in 2018 focus on providing better routes and altitudes, saving fuel and time. They spend less time controlling and more time managing your flight, a little like airline flight dispatchers. But in the end, you are always in charge.

The data link dramatically reduc-

As NextGen is implemented, it is anticipated that the appearance of Air Traffic Control Centers will evolve. Radar will remain a part of the system.

es radio congestion and misunderstandings. You used to be asked to change frequencies as many as 25 times on a long trip. Now frequency changes and routine information such as altimeter settings and required weather advisories are sent by error-free (a benefit of data networking) data link.

If weather forces amended clearances for multiple aircraft, they are all sent by data link at once, reducing controller and pilot workload and saving radio time.

An ATC software tool called the Safety Management System identifies things like potential conflicts with other aircraft or weather issues along your route of flight. SMS recommends path or speed changes to eliminate the conflict. The controller sends you by data uplink the proposed change. When you and the controller agree on the change, it is loaded into both the ground and your aircraft's systems.

Here in 2018, better quality weather information is plugged into controller decision support software tools. They help controllers make the best decisions and greatly reduce their workload during bad weather. This same capability also exists in some airborne equipment.

Unlike the old days, your flight can be assigned precision offsets to the published route. These offsets turn a single route into a multi-lane highway. Offsets increase airspace capacity and can be tailored for individual flights. Since final agreement is reached via data messaging, complex reroutes can be more detailed than those conveyed by voice.

Descent and Approach

Terminal area operations in 2018 are greatly streamlined to save fuel and



minimize maneuvers such as holds and delaying vectors.

Controllers know you're coming even from hundreds of miles away, a feature not possible with earlier Center airspace boundaries. Your data link tells them your proposed arrival time. Accordingly, sequencing and route assignments will be exchanged with the aircraft to negotiate a final flight path containing no potential conflicts and assuring an efficient arrival.

Reduced Separation

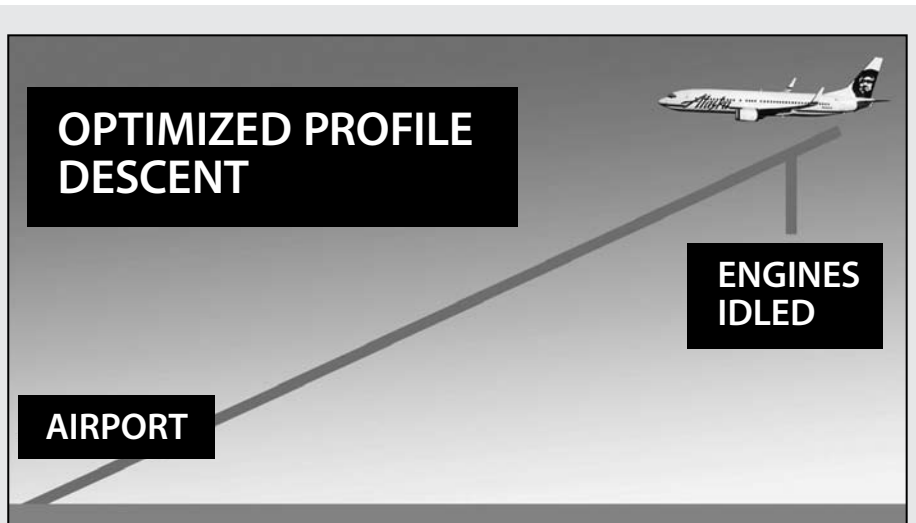
Safely reduced separation means more available airspace. Descending aircraft are managed in a unified way. New RNAV STARs incorporate multiple precision paths that maintain individual flows to each runway.

Equipped aircraft fly precise, smooth vertical and horizontal paths, called optimized profile descents, from cruise down to the runway as opposed to 2009's inefficient step-downs.



Redesigned airspace permits precision three-dimensional paths usable in combination to provide efficiently interleaved arrivals and departures.

This flexibility permits safe departures and arrivals in bad weather, restoring capacity that used to be



An airline bean counter's idea of the perfect approach is to chop the throttles to flight idle at the top of the descent and essentially approach the airport in a long glide, adding power only at the configuration change on final approach. With powerful processing and instantaneous data on aircraft position, Next Gen may at least get pilots in a position to fly this sort of profile more often than not. Fuel savings—not to mention reduction in congestion—would be substantial, if it works.

lost in inclement conditions. Back in 2008, 70% of delays were due to weather. In 2018, delays are down by 30-40%, and the system is still not fully implemented.

Landing and Taxi

Before you land, the preferred taxiway to exit the runway and the taxi path to your preferred parking is uplinked to you by the Surface Traffic Management system at your arrival airport.

Again, your display and the controller's display show the same aircraft movement. The system again helps with efficient flow and reduces the potential for runway incursions. Before you shut down, a message pops up on your Garmin 5000: "Close Flight Plan?". You hit enter. Congratulations, you have arrived in 21st century style!

Back to 2009

Essentially every current form of GPS navigation is incorporated into the NextGen Implementation Plan, such as GPS T-routes and approaches. The plan calls for 300 new LPV

approaches per year until 2015, especially in more rural areas.

NextGen and ADS-B (Automatic Dependent Surveillance-Broadcast) are not synonymous. NextGen incorporates four additional components into a "system of systems":

1. SWIM or System-Wide Information Management provides uniform information to all NextGen users;
2. The data link mentioned earlier;
3. Network-enabled weather;
4. A new ATC voice network.

Deployment

ADS-B is on-line along the Eastern seaboard. In 2010, the Gulf of Mexico will receive ADS-B coverage as Ground Based Transceivers (GBTs) are mounted on oil rigs offshore. The improvement in airspace utilization will be dramatic. Lacking radar coverage, longitudinal separation between aircraft is 100 nm. With ADS-B, it will be only five miles.

Also in 2010, ADS-B installations are slated for Juneau, AK, Philadelphia, PA and Louisville, KY

where UPS will be testing optimized profile descents. All 794 GBTs are expected to be installed by 2013.

Aircraft location with ADS-B is updated each second. In an emergency, ATC will know where to look for you – even more important since satellite monitoring of 121.5 MHz ELTs ended earlier this year and 406 MHz units have lagged in popularity.

The Transition

The FAA plans to decommission most of its 1000+ VORs starting in 2010, first where they are unneeded or where satisfactory alternatives exist. As GPS takes deeper root, more will follow. Currently non-WAAS IFR GPS users must have an alternate form of navigation; for most of us that's VOR. Accordingly, the FAA plans to keep a skeleton network of VORs in place for short-term use until GPS service is restored.

About 1200 Category I ILS's will be decommissioned as LPV approaches supplant them. The hundred or so Category II and III approaches will remain ILS-based until the Local Area Augmentation System comes on line in 2013. LAAS also supports Cat I approaches. Eventually WAAS and LAAS will mean the end of the ILS, probably by 2020.

The sole survivor is DME. It will continue to support en route navigation and independently back up GPS and GPS/WAAS. In fact, the FAA plans to buy about 50 new high-power DME units by the end of 2015. They will provide redundant RNAV area navigation for en route operations around major airports.

NextGen promises an enormous increase in IFR safety, comfort and efficiency. There just couldn't be a better time to be an instrument pilot.

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