Flight Planning
A discussion of fuel cost containment relevant to fuel planning

Just over one hundred years ago, man’s dream of flying was achieved. From that first-flight event to today’s complex manned flights into space, several constants continue to control flight.

Although man has been able to effectively conquer the laws of physics and escape the bounds of gravity, flight aerodynamics have remained constant over the years.

What has changed is the ability to uplift greater amounts of payload due to improved power plants that produce greater thrust and speed, and the reduction of the force of drag due to sleeker aircraft design modifications.

The second constant — the purpose of flight — is the desire to successfully maneuver or navigate from one point to another. Navigation is the art and science of moving from the point of origin or departure to the point of destination without losing your way.
In the early days of aviation, navigation was mostly an art. The simplest instruments of flight had not been invented, so pilots used ‘dead reckoning’ or flew ‘by the seat of their pants.’ Over the course of the last one hundred years, navigation has become a science, and this is where our discussion begins.

The Flight Plan

In order to navigate, a pilot needs a plan — a flight plan — which is constructed based on several relevant pieces of information:

- Starting point (point of departure),
- Ending point (final destination),
- Direction of travel,
- Distance to travel,
- Aircraft speed,
- Aircraft fuel capacity,
- Aircraft weight and balance limits.

The flight plan captures aircraft performance data from the aircraft manufacturers, current weather to include current and forecasted temperature, wind speed and wind direction, number of passengers, passenger bags and other cargo information.

A flight plan provides the pilot with direction on the route of flight from departure city to destination city, altitude to fly, speed to fly, fuel to carry and aircraft performance factors such as takeoff power and flap settings. The flight plan is supported by a briefing package that includes local, enroute and destination weather information, navigational data for the route of flight and appropriate airport data. Airport data is augmented by NOTAMs, a notice which provides the pilot with critical operational information such as runway closures, runway shortenings or out-of-service navigation aids. The flight plan is the technical plan for the execution of each flight that meets the legal and safety requirements pertaining to:

- Airworthiness of the aircraft,
- Weight limitations (amount of weight the specific aircraft can carry),
- Route and altitude requirements.
- Required fuel (fuel to get from point A to point B and to any alternate airport if problems arise).

In addition to the safety aspect, flight planning can impact the economics of the flight utilizing the following techniques:

- Selecting the most economical route and altitude considering weather and air traffic control constraints,
- Controlling the flying time as it relates to the flight schedule and its impact on the overall airline schedule,
- Managing fuel load to account for fuel allocations, availability and price differential between airports,
- Controlling the departure time based on destination weather to avoid unnecessary diversions,
- Maximizing payload capabilities.

Virtually all airlines operating jet equipment have a flight planning or dispatch office. Flight dispatchers and flight planners are required to have very comprehensive knowledge of various aviation disciplines such as weight and balance, the air-traffic control system, meteorology, government regulations that control aviation within a country, air navigation and communications to name a few. The timely coordination and application of these disciplines by the dispatcher or flight planner are designed to produce a safe, reliable and economical flight operations system.

Monitoring every flight requires the dispatcher to employ state-of-the-art technology such as air-ground radio communications, weather radars, aircraft tracking systems, satellite telecommunications and powerful computer systems. From issuing severe weather avoidance information to assisting flight crews with airborne emergencies, the flight dispatchers are the eyes and ears for every airline’s flight operations.

While the first priority in flight planning is to meet all safety and regulatory requirements,
Every extra pound of weight burns approximately 3 percent extra fuel per hour.

the flight planning process can have a dramatic economic impact through optimization of route, altitude, speed, payload and fuel. The flight planning system plays an important role in determining the dispatcher’s and flight planner’s productivity and efficiency in completing their duties.

An advanced flight planning system enhances the individual’s skills and provides a more efficient operation. Gathering routine information such as weather, NOTAMs and aircraft restrictions can be labor intensive, thereby eroding efficiency and productivity and inducing a greater potential for errors. Enhancing the level of systems integration or interface enables dispatchers and flight planners to focus on the most critical tasks and problems at hand, permitting ‘management by exception.’ The use of an effective flight planning system also provides greater standardization in procedures and policies that are designed to save time, fuel and crew costs.

Reducing Fuel Consumption

Through Enhanced Flight Planning

Three major factors that affect aircraft fuel consumption include the weight of the aircraft, speed of the aircraft and wind resistance.

Reducing the weight of an aircraft will reduce fuel consumption because the engines will work less to maintain flight for a lighter aircraft. There are several methods used today to reduce the weight of the aircraft:

- Remove unused or non-essential items such as pillows, blankets, magazines, magazine racks and certain galley equipment that were onboard to enhance passenger services,
- Remove primary and outer paint to reduce the weight of the aircraft. This method was used by airlines during the 1970s’ fuel crisis when fuel prices soared.
- Introduce the electronic flight bag. One of the many positive aspects of the electronic flight bag is the reduction of paper in the cockpit. This would include the many manuals (and weight) needed for airport and aircraft performance data.

But the greatest amount of weight that can be reduced on the aircraft is the additional or contingency fuel that is not required for legality of flight. The amount of fuel required is based on several calculations. First, the amount of fuel needed to fly from origin to destination is calculated based on fuel burn rate for the type of aircraft, the weight of the aircraft and the winds. Second, an airline’s dispatcher calculates an additional amount of reserve fuel for holding at the flight’s intended destination and diversion to a planned alternate. Added together, the result is the fuel load required to legally operate the flight.

When additional fuel is carried above the legal amount required for a flight, more fuel is burned due to the extra weight of this additional fuel. As a rule of thumb, every extra pound of weight burns approximately 3 percent extra fuel per hour.

In some cases, the opposite process is more cost effective — add more fuel than is needed to fly to the next destination, known as fuel ferrying or tankering. Tankering is the term for loading fuel used for subsequent flight segments. Airlines analyze fuel costs at each airport to which they fly, and then calculate the costs of flying (tankering) additional fuel from one airport to another versus the cost of buying fuel at the destination airport. The additional cost of carrying additional fuel can be lower than the price of purchasing additional fuel at the destination airport.

In addition to reducing aircraft weight, there are several ground procedures that can be modified that will also reduce fuel usage, such as:

- Using only one engine when taxiing,
• Shutting down engines during ground delays as appropriate,
• Using ground tugs for aircraft movement on ground,
• Using electric ground power units instead of the onboard auxiliary power units powered by jet engines and jet fuel to provide electricity and ground-conditioned air when on the ground.

Improved Flight Planning Procedures

Automating dispatch and flight planning functions has changed flight operations around the world. Today’s automated flight planning systems help reduce fuel costs through new flight planning techniques working in concert with new navigational technology, including:

• Using cost index-based flight planning used in conjunction with the onboard flight-management computer to optimally calculate flying speed based on winds and aircraft weight,
• Utilizing reduced vertical separation minimal to enable greater access to fuel-efficient routes that are now available due to the increased altitude separation requirements,
• Lowering cruise speed when possible to reduce in-flight fuel consumption and avoid early arrivals and extended ground holds waiting on a gate,
• Utilizing more precise navigation tools such as global positioning satellites and better wind forecasting methods to reduce excess fuel on international flights.

Conclusion

Introduction to new technologies continue to make significant improvements in the art of flying. To take advantage of these new technologies today, airlines need more advanced automated flight planning systems that will provide the optimum flight plan based on the flight environment at time of departure or even during the flight. Considering all factors that effect a flight, the automated flight plan aligns with the new technologies of aircraft and navigational systems to produce the flight plans that minimize flight time, improve aircraft productivity and minimize maintenance time while reducing operational costs such as fuel. Aerodynamics have not changed. Aircraft operations has.