

# International Quality Management Systems and Aviation System Standards (AVN)

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## ABSTRACT

Aviation's demand for more instrument flight procedures, coupled with rising flight inspection production costs of fuel and aircraft, shrinking budgets and reduced personnel levels, demand Aviation System Standards' (AVN) adherence to best business practices.

- Jet fuel that was \$1.05 per gallon in 2004 costs \$3.47 per gallon in 2008 and will continue to rise in price.<sup>1</sup>
- Salaries for specialized flight procedure production personnel, pilots and maintenance personnel have risen while overall departmental budgets have not shown a similar increase.
- Aging aircraft must be replaced with costlier models or upgraded with more expensive avionics and flight inspection equipment.
- Inefficient charting production software must be replaced.
- Aircraft maintenance costs for parts and labor have increased dramatically.
- The numbers of specialized cartographers and aeronautical information specialists have plateaued while the quantity of flight procedures being reviewed, amended and commissioned continue to rise at a quickening pace.

To meet increased production demands, AVN's management must continually implement cost savings and production efficiencies. By implementing internationally recognized quality management systems, AVN assures the continuation of its mission that includes validating navigation system aids (NAVAID), facility

commissioning and periodic validation of NAVAIDs. The mission also includes emergency outages/restorals, helicopter support of RNAV (GPS) approaches for emergency medical services (EMS) offshore petroleum services, and corporate/public facilities. FAA/AVN, under a FAA/USAF (Air Force) memorandum of agreement, is also responsible for all Department of Defense (DoD) flight inspection requirements, including those required to support combat operations.

## INTRODUCTION

Aviation System Standards (AVN) is the principle element within the Federal Aviation Administration directly responsible for the flight inspection of air navigation facilities throughout the United States and its territories. The certification of these navigational aids and related instrument flight procedures is critical to the safety of the United States' National Airspace System (NAS) and the flying public.

AVN employs nearly a thousand specialized personnel located throughout the United States to design, inspect, produce, distribute and maintain over 15,000 aviation charts and 6,500 navigational aids needed by civil and military aviators.

AVN's National Aeronautical Charting Group (NACG) performs over 1,800 chart revisions per 56-day publication cycle, often planning several months or years in advance of a commissioning. To validate the accuracy of these charts, AVN operates a fleet of 31 aircraft containing specialized avionics for the purpose of flight inspection. A fleet of this size requires a considerable amount of resources in fuel, parts and man-hours to fly and maintain. With rising costs and a shrinking budget to pay for these resources, new efficiencies must be realized to offset these financial difficulties.

In 1998, AVN's Aircraft Maintenance and Engineering Group (AMEG) began following and implementing the guidance of ISO 9001:1994, receiving certification and registration in 2001. Already audited and monitored by federal regulatory requirements, AMEG's quality management system still found considerable cost savings, operational effectiveness and process efficiencies by following ISO's tenets.

In 2002, encouraged by AMEG's success with ISO's guidelines, AVN's management explored more options leading to improved communication with vendors, customers and other stakeholders and increased analysis and measurement of the flight procedure product and processes. As a result, AVN gained a better understanding of our internal and external customers' needs, reassigned resources where they were most needed, identified true production unit costs, decreased fuel consumption and explored more efficient use of aircraft and personnel. In 2003, AVN implemented and registered a second ISO quality management system pertaining to its IFP production system.

**INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)**

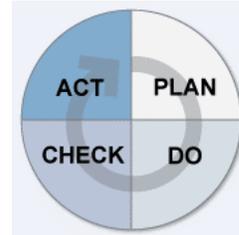
ISO is the world's largest developer and publisher of international standards with 157 member countries represented out of 195 total countries in the world.<sup>2</sup> This international assemblage, issues and revises guidelines that are mandated by some governments and industries while other countries use ISO strictly in the private sector.

ISO 9001:2000 is a standard or guidance document written by the International Organization of Standardization in Geneva, Switzerland. Since beginning in 1979, it has been revised three times – most recently in 2000 – and is number 9001 in a long line of over 27,000 other standards issued and re-issued by ISO. The next revision for ISO 9001 is scheduled for late 2008. The 2000 revision currently gives guidance on how to consistently manage the quality of an organization's product or service by establishing and maintaining a quality management system (QMS)

Primary operating principles for ISO are outlined on the AVN website, <http://avnokc10.amc.faa.gov/isoqm>. These principles are:

- Plan – establish objectives and make plans (analyze the organization's situation, establish overall objectives and set interim targets and develop plans to achieve them).
- Do – implement the plans (do what's planned).

- Check – measure the results (measure/monitor how far the actual achievements meet the planned objectives).
- Act – correct and improve the plans and put them into practice (correct and learn from the mistakes in order to achieve better results next time).<sup>3</sup>



**Figure 1. Plan-Do-Check-Act (PDCA) Cycle – The Operating Principle for ISO**

**ISO 9001:2000 and AVN**

Aviation System Standards' flight inspection operation is only one facet of a larger mission that begins with the development of an instrument flight procedure (IFP) and ends with publication and distribution to the customer. AVN's IFP process was initially certified under ISO Standard 9001:2000 on September 30, 2003, with successive recertification received in September 2007.



**Figure 2. ISO Certificate for the IFP Process**

ISO Standard 9001:2000 was selected for AVN's instrument flight procedure process because it has generic quality management system guidance that can be applied to a government organization.

AVN instituted ISO with the hope of improving process efficiencies and product conformity, but also found that ISO has a positive effect on AVN's safety and risk management efforts, environmental impact, customer and supplier interactions and aircraft maintenance reliability. It is also compatible with established FAA and AVN strategic goals and quality improvement efforts as well as existing regulatory audit and evaluation programs, often enhancing their effectiveness. It requires the implementation of a quality management system wherein AVN will fulfill:

- the customer’s quality requirements, and
- applicable regulatory requirements, while aiming to
- enhance customer satisfaction, and
- achieve continual improvement of its performance in pursuit of these objectives.<sup>4</sup>

AVN’s management created a quality policy regarding its IFP production processes that states, “AVN provides our customers safe, timely and continually improved Instrument Flight Procedures that enable efficient use of the NAS (National Airspace System).”

With this quality policy in mind, AVN implemented, depending on its organization’s IFP production processes, a variety of measurable quality objectives that are continually reviewed, analyzed and formally addressed at the completion of each 56-day flight procedures publication cycle. Examples of the quality objectives for the IFP Flight Inspection Operations Team are:

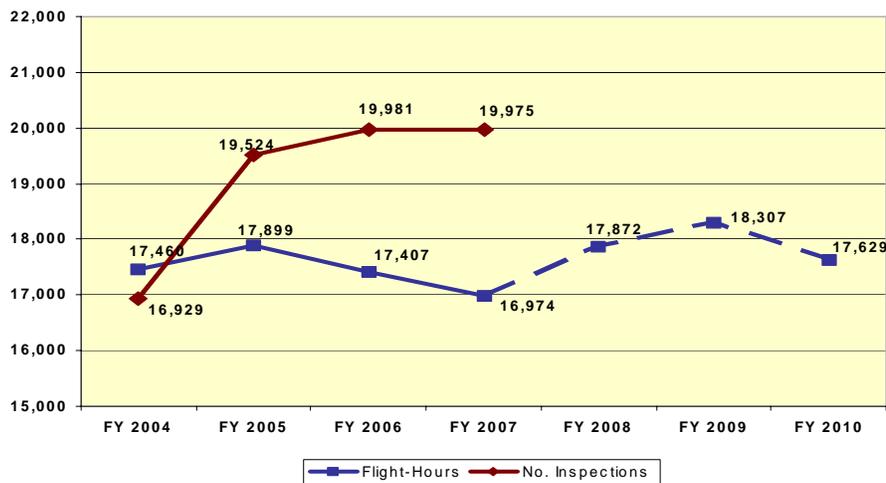
- Reduce the time required to complete 90% of the flight inspection of the routine Instrument Flight Procedure to 45 days or less from the date the package is received. (This requires a balanced approach to prioritizing periodic, special, commissioning and IFP inspections.)
- Reduce the time taken to return 90% of the IFP documentation of satisfactorily flight inspected

IFP’s to the National Flight Procedures Office to two days or less from the inspection completion date.

- Receive 95% of all IFPs complete and ready to flight inspect, requiring no further coordination.

These and other objectives have been realized over the last few years by increased efficiencies in chart production, flight inspection scheduling and coordination, aircraft maintenance, printing and distribution. When management determines an objective has been suitably attained, resulting in improvement of the IFP or any of its production processes, new ones are determined, measured and analyzed with actions taken that lead to further improvement.

AVN now manages the complex task of maintaining the flight inspection requirements for thousands of inspections for an expanding and evolving National Airspace System. Focus has been placed on improving the efficiency of the IFP chart production and flight inspection program through increased training, improved production planning, clear lines of communication, and reliable availability and performance of aircraft and avionics equipment. This teamwork and communication has directly resulted in decreased IFP mistakes and rework and more efficient flight hour usage rates, thereby reducing operational and inspection costs. The graph below depicts recent and projected flight hour usage and the importance of implementing efficiencies now in preparation for future demands.



**Figure 3. Flight Hour Usage – Actual and Projected**

**INSTRUMENT FLIGHT PROCEDURES – SAFER, QUICKER, AT LESS COST**

The efficiencies realized in the IFP (chart) development and flight inspection portions of the IFP production process have played a significant role in enhancing customer satisfaction by *significantly decreasing* the number of days to develop, publish and distribute a procedure.

Before FY-06, the process for obtaining a published instrument flight procedure included several steps that required manual input. These steps could take several days to complete due to human error, downtime, and intervening priorities, severely impacting the timeline.

From the initial request to a published chart required 210 days for completion, on average.

With the introduction of ISO and its principles of process management and continual improvement, new methods of developing instrument flight procedures were analyzed. Objectives were established, targets were set and plans were developed.

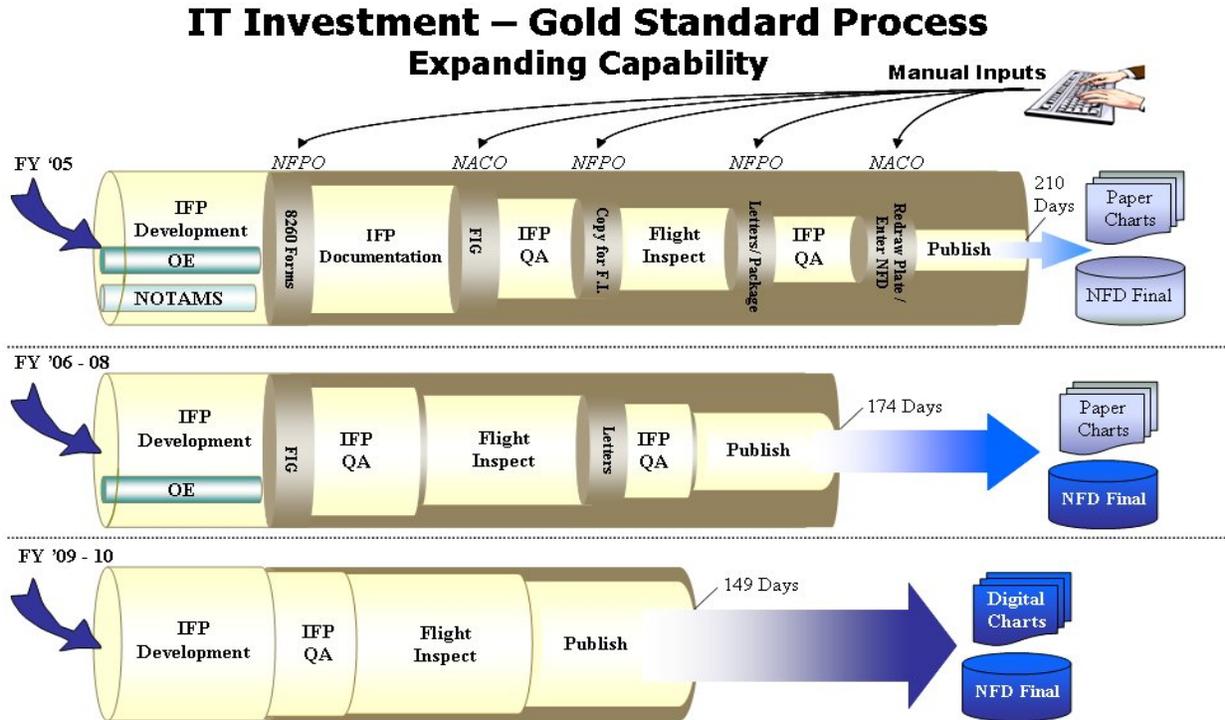
From FY-06 to FY-08, ISO principles were implemented and the timeline for publication of an instrument flight procedure was reduced to 174 days.

**THE “GOLD STANDARD”**

The “Gold Standard” is a controlled process to ensure the Instrument Flight Procedure (IFP) design, data used and ARINC record are successfully flight inspected and entered into the National Flight Database (NFD). This data is considered “Gold,” meaning it is confirmed as being accurate, flyable and safe with processes in place preventing unauthorized changes or contamination of the data.

With continual measurements, corrections and improvements, Aviation System Standards has seen outstanding results. Objectives have been reevaluated and the “Gold Standard” for instrument flight procedures has been established by investing in automation strategies that meet quality and regulatory requirements, while enhancing the customer’s overall satisfaction. In the very near future, the time required for providing a published procedure will be reduced from 210 days in FY-06 to 149 days – an improvement of 29%.

The “Gold Standard” timeline is depicted below:



**Figure 4. The Instrument Flight Procedure Pipeline**

**'THIS IS ONLY PART OF THE AVN QUALITY STORY'**

Shorter production times resulting in a safer instrument flight procedure meeting the customer's requirements is only part of the story. AVN realizes that *all* of the organization must be more efficient to ensure a safe, timely and continually improved IFP.

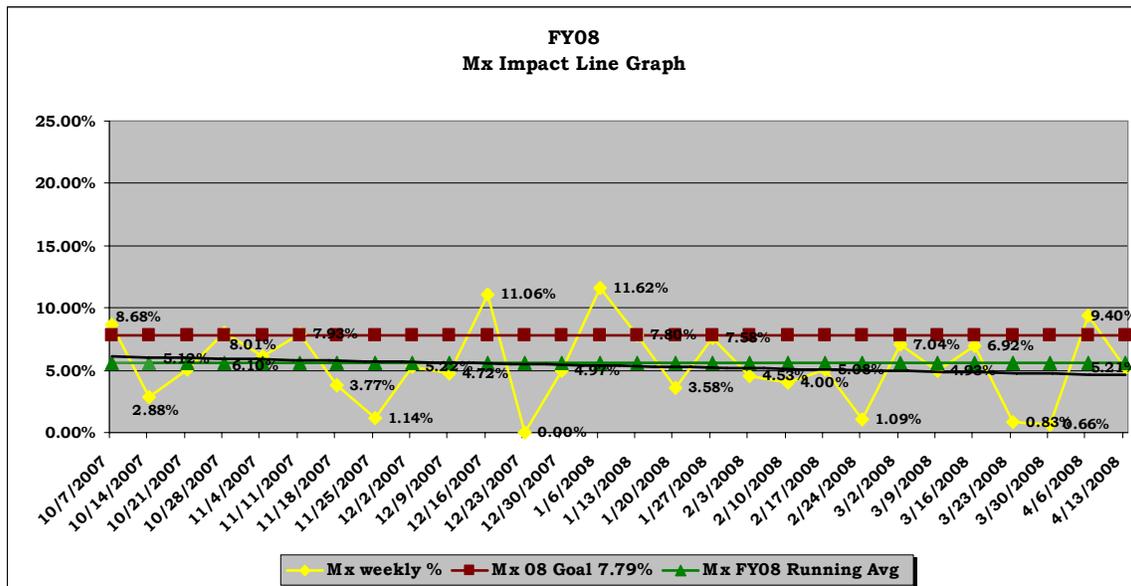
**BUSINESS AND PROGRAM PLANNING SUPPORT GROUP (B&PPS): ISO 9001:2000**

Reporting to the Director of AVN, the Business and Program Planning Support (B&PPS) Group, similarly performs with increased demands and reduced resources. B&PPS supports the entire AVN organization with budget and personnel functions, in addition to partnering with our domestic and foreign customers contracting for AVN's flight inspection services. B&PPS interacts with the flying public seeking Freedom of Information Act (FOIA) data as well as the FAA and United States Government regarding special reports, research projects and information. Practicing continual improvement and providing service excellence based on responsiveness, accuracy and innovation, the Business and Program Planning Staff was certified under ISO Standard 9001:2000 in 2003 and recertified again in 2007.

**AIRCRAFT MAINTENANCE AND ENGINEERING GROUP (AMEG) ISO AS9110: 2003**

In addition to ISO 9001 certification and Federal regulatory guidance, AVN has elected to implement "industry-specific" quality management guidance in the area of aircraft maintenance and engineering.

Based on receiving ISO 9001 certification and registration in 2001 and recertification in 2005, AVN's Aircraft Maintenance and Engineering Group (AMEG) became the *first* governmental aircraft maintenance organization in the world to receive SAE Standard AS9110: 2003 certification in early 2007. Written specifically for aircraft maintenance organizations, there is increased emphasis on customer feedback, vendor/supplier interaction and parts verification, and aircraft reliability, as well as expanded requirements for design process planning, review, verification, validation, change control and production requirements. AMEG has seen considerable success in the past three years through increased production efficiencies that counteract rising maintenance and engineering costs. Focusing on AMEG's primary customer, the Flight Inspection Operations Team, has resulted in increased availability of reliably performing aircraft and avionics equipment. This lessens AMEG's occurrence of negative "mission impact" from ten to twelve percent three years ago to historically low levels currently around six percent. The following charts show the gradual reduction of AMEG's flight inspection mission cancellations and overall improvement of flight inspection operations.



**Figure 5. Maintenance Impact on Aircraft Availability**

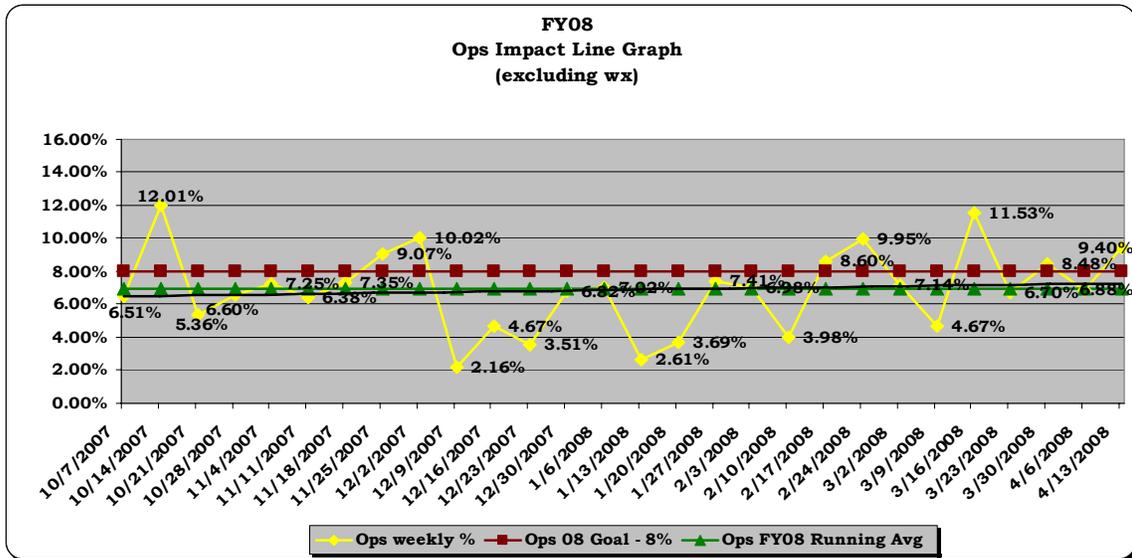


Figure 6. Maintenance Impact on Aircraft Availability w/o Weather

AMEG’s customer feedback surveys for all AVN stakeholders in flight inspection operations were implemented as required by AS9110. While showing a good response rate to the surveys and high customer satisfaction levels, it has also been valuable in determining “recovery time” when there is a flight inspection event that may impact the success of the mission. Data gathered since 2006 indicates customer satisfaction is between 95% and 99%.

with offices in Silver Spring and Glenn Dale, Maryland, practices the beautiful and ancient art of cartography using the most up-to-date cartographic hardware and software. NACG follows ISO directives for employing and maintaining competent personnel capable of this difficult discipline. Such cartographers now require specialized college degrees combined with exceptional spatial reasoning, math and reading skills and an ability to focus on minute details for extended periods of time. Identifying and developing further these important traits through inspection, teamwork and training, the IAPB continues to consistently reduce cartographic errors and rework. Production objectives have been tightened and personnel are not reluctant to work toward long-term goals that make them stretch. The organization, with fewer personnel than five years ago, has consistently handled increasing production capacity with quicker IFP turn-around times.

| Customer Satisfaction Status |                   |               |             |              |
|------------------------------|-------------------|---------------|-------------|--------------|
| Customer                     | # of Surveys Sent | # Respondents | % Responded | Satisfaction |
| Aircrew-FAA                  | 140               | 79            | 56          | 95%          |
| Aircrew-FBO                  | 22                | 7             | 32          | 97%          |
| FICO Dispatch                | 158               | 50            | 32          | 95%          |
| FICO Maintenance             | 157               | 151           | 96          | 99%          |
| Mechanic                     | 142               | 67            | 47          | 99%          |

Figure 7: Customer Feedback

**NATIONAL AERONAUTICAL CHARTING GROUP (NACG) INSTRUMENT APPROACH PROCEDURES BRANCH (IAPB) AND DISTRIBUTION**

Instrument Flight Procedures are depicted on detailed maps showing the “highways in the sky” all aviators must safely travel. The National Aeronautical Charting Group,

Sent to flight inspection operations, the IAPB provides correct, accurate IFP data and graphics needed to successfully complete a flight inspection *effectively* (having the correct charting data, the first time) and *efficiently* (more accurate charts and flight inspection coordination result in less interruption to an airport’s operations and less fuel burned by flight inspection during the validation phase of IFPs). The IAPB is, likewise, registered to ISO 9001 for the IFP production process. Figure 7 on the next page shows an ambitious *long-term goal* to reduce chart compilers’ charting errors on safety critical items caught by the reviewer prior to publication, to *less than 15%* for amendments, originals, and P-NOTAMs per 56-day cycle. The positive trend shows a gradual reduction in errors as the result of IAPB’s

gathering and analysis of data coupled with training and improved communication with the compilers regarding the nature of the errors.

All errors were found and corrected before they were sent to publication.

to create easily understood desk procedures that permit them and new hires to “hit the ground running” when servicing their or other’s sales accounts after suitable and documented formal and on the job training.

Unmeasured before implementing ISO’s requirements for

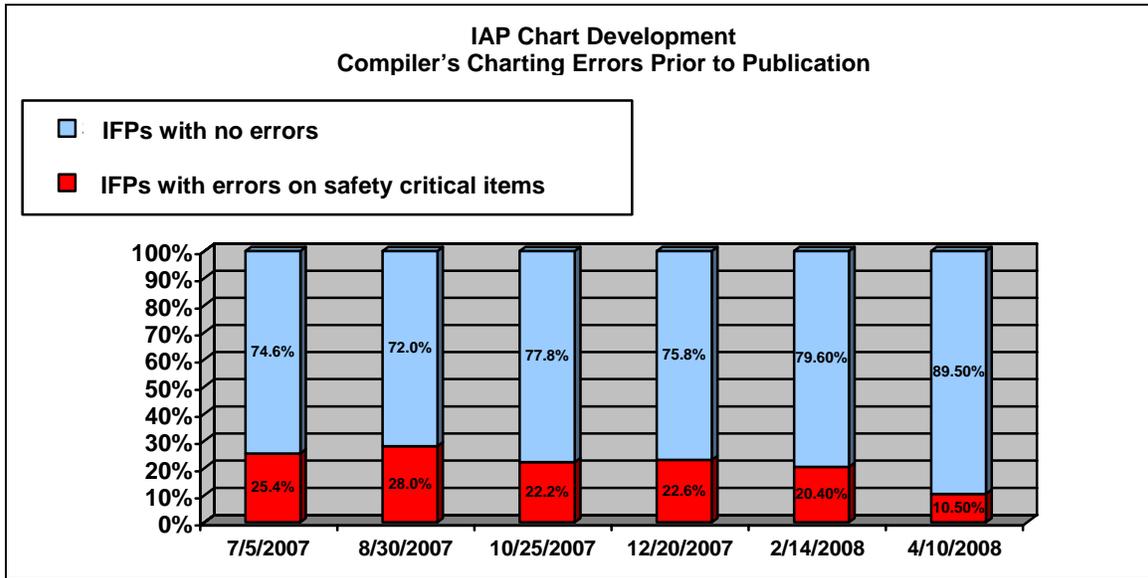


Figure 8: Charting Errors Prior to Publication

**AERONAUTICAL CHART DISTRIBUTION – CUSTOMER FOCUS**

A basic principle of ISO is that “every business begins and ends with the customer.” ISO has encouraged AVN to determine and establish easily accessed channels of communication and points of live contact between AVN and the customer. Their customers include several thousand “chart agents” who purchase and sell charts in various locales around the United States and abroad. Other customers include individual civil aviation pilots, commercial and transport aviators and airlines, medical facilities, the U.S. military, industrial manufacturers, ranchers, sport pilots, helicopter pilots and other domestic and foreign government agencies. Whether it’s a recurring order for several thousand charts covering a specific geographical section of the country, a large metropolitan area or just an individual flying to the next city to visit relatives, each chart must be ordered, verified, selected and shipped with the same care. At night or in inclement weather, aviators’ and passengers’ lives depend on the accuracy and currency of an instrument flight procedure. Distribution’s sales personnel have built professional relationships with many of their customers and they are proficient in listening skills. ISO’s requirement to document important processes has inspired the sales staff

measurement and monitoring. Distribution’s order fulfillment and shipping data often indicates an error rate of less than one, one-thousandth of one-percent (.001%) by shipping the correct order to the customer on time and at the agreed price. Following ISO continual improvement guidelines and taking proactive preventive action, the Distribution Team working with the Transportation Manager can now assure that most orders are shipped the same day they’re received. With very few exceptions, these orders are received over-night or, depending on more extreme distances, in one to four days or less. Recent distribution advances allow digital procedures to be downloaded from the Internet in a few minutes.

**14001:2004 - AVN’s Environmental Management System**

With the success of ISO 9001 and AS9110, AVN continues to rely on internationally recognized management systems for other business and regulatory reasons. AVN is currently working toward future certification and registration under the guidelines of the Environmental Management System (EMS), ISO 14001:2004. AVN has several environmental issues contained within its IFP production and aircraft maintenance processes and has already realized great

savings through flight inspection scheduling that have greatly reduced fuel consumption and air pollution. AVN's recycling program is the right thing to do, as well as good business, and demonstrates AVN's commitment to being a good steward of the environment and the taxpayers' investment in government. AVN has been able to anticipate and remediate potential environmental impacts to its organization and the many communities in which it works. AVN strives to establish, implement, maintain and improve an environmental management system by identifying environmental aspects that it can control and those that it can influence. AVN's environmental management policy was established on July 10, 2007, with certification and registration expected in the first quarter of 2009.

**CONCLUSIONS**

By consistently managing the quality of its products and services, AVN can demonstrate to itself, its customer and the taxpayer that it has the ability to consistently provide a safe, timely and continually improved product or service at the best price, continually improving it through customer feedback and analysis of process and product measurement.

Following ISO's management system principles is a good business decision by AVN's management. AVN has been able to greatly reduce its expenses linked to the design, production, flight inspection (validation), printing and distribution of Instrument Flight Procedures. AVN is striving to be a responsible corporate citizen of the world by spending the taxpayer's money wisely and effectively. Based on thorough analysis of data, AVN produces a safe instrument flight procedure as quickly as possible with an economy of resources. The final graphic clearly shows that, despite increased demand for flight inspections and a doubling of fuel expenses in the last 24 months, AVN has been able to maintain the average cost per flight hour (adjusted for fuel increases), reduce the overall cost per inspection and shave over one-million dollars off the total costs of our flight inspection program.

|                               | FY 2006      | FY 2007      |
|-------------------------------|--------------|--------------|
| Avg. Cost per Flight Hour:    | \$2,101      | \$2,108*     |
| Cost per Inspection:          | \$1,931      | \$1,878      |
| Total Cost                    | \$38,581,371 | \$37,521,061 |
| * Adjusted for Fuel Increases |              |              |

**Figure 9: Cost Savings**

While proving to be a cost-conscious servant of the taxpayer, AVN is a responsible caretaker of this world, helping the aviation traveler move from point to point as safely and efficiently as possible with the least possible amount of impact on the environment.

With the knowledge derived from knowing how to satisfy our customer, improve our product, use our limited resources effectively and preserve our environment, AVN will continue to change for the better, using internationally recognized management standards (ISO and others) to better serve our customers and ourselves. This will permit us to continue our mission of providing services to ensure the standard development, evaluation, and certification of airspace systems, procedures, and equipment for customers worldwide.

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