FO OUTLOOK
NASA AMES RESEARCH CENTER

Information for the NASA Ames Aeronautical Test & Simulation Community December 23, 2000

LARGE ROTOR TEST APPARATUS INSTALLED IN 80X120

By Tom Norman

Large Rotor Test Apparatus in 80X120

A significant operational milestone for NASA's Rotorcraft Program was met on September 21, 2000 with the installation of the Large Rotor Test Apparatus (LRTA) in the 80- by 120-Foot Wind Tunnel. This installation (see first figure) is the culmination of a substantial development program. This effort provides a unique national capability for testing moderate-to-large helicopters and tilt rotors in the NFAC.

As part of NASA's Rotorcraft Program, NASA is committed to providing the experimental rotorcraft data necessary to validate newly developed predictive capabilities, and provide physical insight into those areas where accurate predictive capability does not yet exist. NASA is also committed to reducing (either directly or indirectly), the design-cycle time for Government and Industry-led rotor programs. The LRTA provides these capabilities for large-scale rotors.

The LRTA is a wind tunnel test stand designed for testing helicopter and tilt rotors up to a 50,000 lb thrust and 6,000 Hp. Developed jointly by NASA and the U.S. Army, the LRTA provides unique operational capabilities. These include the ability to measure both steady and oscillatory rotor hub loads using a five-component balance and an instrumented flex-coupling. It also provides conventional collective and cyclic pitch control as well as dynamic high-frequency blade pitch control.

The fabrication and initial acceptance testing of the LRTA was completed in January1995, and delivered to Ames in February 1995. To bring the LRTA to operational status, a number of tasks remained. These included the calibration of the rotor balance, the design and fabrication of a rotor control console, the fabrication and installation of fuselage components, and final acceptance

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FULL-SPAN TILTROTOR AERACOUSTIC MODEL

By Deo Singh

40 X 80-FOOT WIND TUNNEL TEST

The Tiltrotor Aeroacoustic Model (TRAM) has been a major project within the Aeromechanics Branch (ARA) of the NASA/ Army Rotorcraft Division for the past 10 years. TRAM is a quarter-scale, half-plane/half-helicopter hybrid model currently mounted in the test section of the 40 x 80-Foot Wind Tunnel. Testing on the model may be extended into 2001.

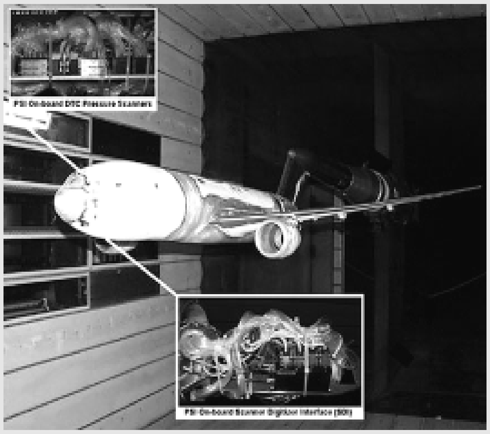
The main objective of the TRAM program is to develop a comprehensive platform to study the noise-generating mechanisms of tiltrotor aircraft. The U.S. Marines, Navy and Air Force will use tiltrotors as a primary cargo aircraft with vertical takeoff and landing capabilities. The transition of tiltrotor technology from military transport to civilian transport can be extremely valuable to the future stability of today's crowded airports. Fixed-wing commuter aircraft are currently used for short-haul transportation; but add to congestion since they use the same runways as larger passenger aircraft at hub airports. Airline traffic is forecasted to grow significantly over the next 20 years; and an aircraft that has the ability to fly passengers from outlying vertiports to regional hub airfields would be an ideal solution. The concept of employing a 30 to 40 passenger commuter

FS TRAM Engineers Examining The Model

(Please turn to page 5)

DTC TECHNOLOGY SHOWCASED AT AMES

By Daniel Loney



B777 3.7% Model Instrumented with DTC Technology

In the challenging and competitive market of aerospace testing, our customers expect shorter cycle times at a reduced cost. One major movement forward in productivity has been the recent application of Digital Temperature Compensation (DTC) technology to pressure measurements.

Our wind tunnel Standard Data System (SDS) uses the Pressure Systems, Inc. (PSI) pressure measurement equipment for acquiring data from models and various wall interference correction systems. The basic PSI system contains a computer, in-line pressure calibrators, and high channel capacity pressure transducers known as scanners. Unfortunately, these conventional PSI scanners are prone to drift under changing tunnel conditions, requiring frequent calibration and they are susceptible to electrical noise generated by the tunnel systems. It has been noted that PSI system re-calibrations can occur as frequently as once per hour depending on varying wind tunnel conditions. As an example, the 12' PWT circuit operating temperature can vary between -15° to 50° C causing large zero shifts in surface pressure data. Typically, researchers desire an accuracy of 0.05% for full-scale output. If the PSI scanner temperature changes by only a few degrees, the specified accuracy can not be met and a time consuming re-calibration is necessary.

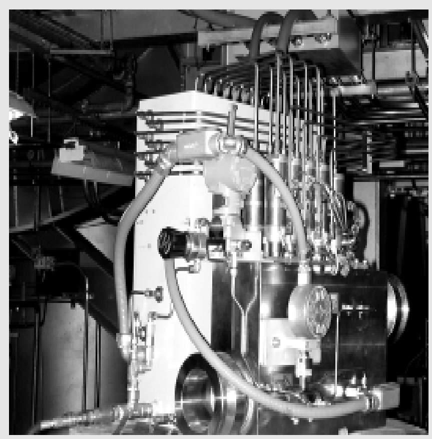
Ames, as a Beta user, has partnered with PSI in engineering and testing newly developed hardware that includes the DTC scanners, Scanner Digitizer Interface (SDI) and Remote Power Supplies (RPS). The DTC/SDI/RPS configuration of the 'new' PSI system represents a major breakthrough and advancement in electronic pressure scanning devices for wind tunnel applications. The technology dramatically enhances data quality while equally increasing productivity. The new system is able to perform real-time temperature compensation on pressure scanner data significantly improving overall accuracy and reducing the frequency of on-line calibrations and when required, the time to perform them.

(please turn to page 4)

HIGH PRESSURE AIR CAPABILITY

By George Swaiss

The FO Division's 3000 psi High Pressure Air System (HPAS) is used to supply high-pressure air to models in the 12-ft, Unitary and NFAC wind tunnels. With this unique capability, wind tunnel models can be fabricated and operated to simulate the interactive thrust effects of jet and/or rocket engines. This article addresses the current modifications and improvements for the Unitary's 11-ft test section. This high pressure air capability is just one of the many systems that contributes to the World Class standing of the Ames' wind tunnel facilities.



Control Panel for the HPAS Valves and PLC Interface

The improved HPAS installation at the 11-ft takes advantage of our experience with the 12-ft and the NFAC wind tunnels. The new digital valves, heater and controls is similar in its mechanical configuration and operation to the 12-ft and provides the 11-ft with two separately controlled air-lines that give a very accurate air supply (0.01 pound per second increments). One of the two separately controlled air lines has an inline 1 Mega Watt heater that supplies heated air from 0 to 40 pounds per second. With the combination of the digital control valves and inline heater, varying amounts of high-pressure air can be accurately delivered to the model to within two degrees Fahrenheit. The new control system and software is similar in configuration to the NFAC.

To improve safety and productivity, the 11-ft High Pressure Air System is automated to run from a single computer, using a graphic control screen to accommodate control of remote set points, mass flow, pressure and temperature. To add safety in the event of an emergency, an "E-stop" has been "hard wired" into the system independent of the computer controls.

The systems of the 11-ft HPAS have all been installed by Ames' on site contractors. March Metalfab installed pipe modifications, heater, and pressure components per the ASME Power Piping Code B31.1 and NASA AHB 1700-1. All of the new components meet or exceed the code requirements for the proposed service. The new piping and components have successfully passed a hydro-test at 4,950 pounds per square inch gauge (1.5 times the MWAP). The P&L Electrical Company completed all electrical and control modifications.

The 11-ft HPAS Integrated Systems Test (IST) is scheduled to start this October getting the system ready for its first customer Boeing. The IST testing includes the integrated computer controlled performance of the digital valves, the heater, and system controls for safe and consistent operation of accurate air supply, temperature control, normal and emergency shut-off conditions.

THE 11-FOOT TURNTABLE MODEL SUPPORT *By Ed Newman*

The turntable model support system is used to mount and test large "semi-span" models in the 11-Foot wind tunnel. The primary purpose is for testing wing and engine configurations at a larger scale than a typical full span model would allow. A "full span" model is one that looks like an aircraft. It has two wings, a fuselage, and a tail section. A "semi-span" model is one where the aircraft is cut in half, lengthwise. Thus the model has half a fuselage, half a tail, and one wing. The model is mounted on its side with the wing up. The new turntable is a replacement for the older, lower capacity, less accurate system, which was removed during the modernization project.

"The primary purpose is for testing wing and engine configurations at a larger scale..."

The heart of the system is the turntable mechanism. It is essentially the base of a large milling machine. These machines, built for the machine tool industry, are designed to be extremely accurate in positioning large heavy objects for precise machining. By purchasing a commercially available mechanism, the cost of the system and overall risk were significantly reduced.

The new turntable system accepts its commands from operator inputs through the Distributed Control System (DCS). The commands in turn are manipulated by the position controller and sent to a variable speed motor. The new turntable can position a model to an accuracy of +/- 0.05° and handle loads up to 500,000 in-lbs. It can pitch a model at 5 degrees/ second and accelerate at 1 degree/sec^2.

The turntable system is a true example of teamwork. The staff of the Unitary Modernization Project designed the turntable. The turntable mechanism was manufactured by Ferguson Corporation. Dillingham Construction installed it and Accutronic built the control system. Science Applications International Corporation performed the integration of the Accutronic controller to the Tunnel DCS. The project staff and Code FO are activating the system.

With that many cooks, it's hard to believe that the system will ever work. But guess again; the system is now being run through its paces in preparation for a customer test next summer. Final control system corrections are being made and are being tested in preparation for the Integrated Systems Test this fall.

(Please turn to page 5)

LARGE ROTOR TEST APPARATUS INSTALLED IN 80X120...

(Continued from page 1)

testing. Through the dedicated and concerted efforts of codes ARA and FO, the last of these tasks are now complete. .

Rotor Balance Calibration Facility for Large Rotor Test Apparatus

Two of the most significant tasks were finished in the past few months. The first was the calibration of the LRTA rotor balance (see second figure). This calibration effort demonstrated the viability of the LRTA balance design to measure rotor hub loads to better than 0.5% full-scale. This level of load measurement accuracy is critical to the successful wind tunnel testing of large rotor systems.

The second major task was the design, fabrication, and integration of a state-of-the-art digital rotor control console for use with the LRTA. This new console provides the digital commands and feedback controls necessary to safely "fly" a rotor system in the wind tunnel. In addition, it provides the capability to control the LRTA dynamic actuators, implementing dynamic high frequency blade pitch control up to 30 Hertz.

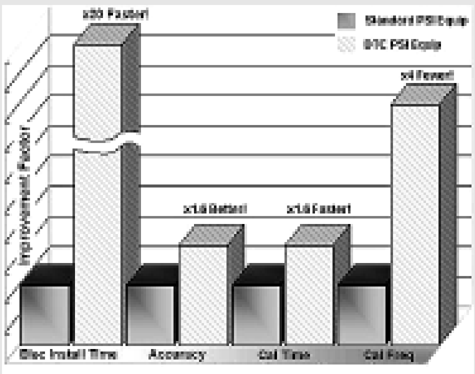
With the successful completion of this development effort, the LRTA is now ready to become the workhorse facility for NASA's large rotor experimental programs. There are currently two major programs identified for the LRTA with future follow-on programs identified.

The first program to use the LRTA is a joint NASA/Army/Sikorsky/German effort to determine the benefits of Individual Blade Control (IBC) for noise, vibration reduction, and performance improvement. Initial checkout of the IBC system will be performed in the 80x120 this fall followed by a high-speed test in the 40x80 next spring.

The second program is a joint NASA/Army/Boeing effort to evaluate the aerodynamic and dynamic properties of a new rotor system. The new rotor system is designed as a possible replacement for the current AH-64 Apache rotor. This program is scheduled to begin in the 40x80 in February 2002.

Follow-on programs with the V-22 and the UH-60 have also been tentatively planned, which should keep the LRTA (and NFAC) busy for the foreseeable future.

DTC SHOWCASED AT AMES... *(continued from page 2)*



Benefits of DTC Technology

The DTC scanner connects to a very compact unit called an SDI. The SDI resides within the model that digitizes and transmits pressure data over a fiber optic link back to the control room for further processing.

The actual fiber of the cable is the diameter of a human hair, which greatly reduces the balance bridging offered up by the bulky cable arrangement of older equipment. Another benefit to the fiber optic link is its apparent immunity to data contaminating electromagnetic fields generated by some of our model support systems.

It is recognized that there is usually a higher emphasis put on force and moment data quality. However when high precision pressure data is required there is no substitute for DTC technology to help guarantee a successful test.

One example is the completion of the calibration of the 11' last fall that used the static pipe. With Ames paying for the in-house testing costs coupled with increased schedule pressures, the duration of the Static Pipe Test had to be condensed. For the test now to be successful, high productivity was required. This was a critical tunnel calibration test for determining final mach number table corrections, so no tradeoffs on accuracy for productivity could be allowed. A command decision was made by management to rapidly deploy DTC equipment to the Static Pipe Test. The results were very positive with all test objectives being accomplished in the time allotted.

In an earlier installation of the Static Pipe Test that used standard PSI equipment, calibrations were required once per hour, in most cases amounting to an average of 10 minutes of productive wind-on time per hour. From the most recent test using DTC technology, the ease of electrical installation was over a magnitude faster due to fewer connections. We increased accuracy by a factor of 1.6, while reducing calibration duration time almost half. But most importantly, calibrations were now throttled back to twice per shift eliminating non-productive tunnel time with an approximate cost and power savings of $4,300 per shift.

Since the completion of Static Pipe Test, all 11'TWT and 12'PWT tests have required DTC equipment as a 'must have' technology. Considering the high return on investment, we hope to grow our scant DTC scanner inventory to support such upcoming programs as JSF. In the future, we will continue to seek opportunities to improve our PSI system by evolving DTC technology to meet our challenging and ever changing environment.

X-37 IN 11FT AND 12FT *By Jules Gustie*

The X-37 was tested at NASA Ames from September 5 through October 16, 2000 in the 12-Foot Pressure Wind Tunnel (PWT) and the 11-Foot Transonic Wind Tunnel (TWT). The X-37 is a small, unmanned vehicle designed for demonstration and experimentation of spacecraft technology. It is part of NASA's Advanced Space Transportation Program (ASTP). The first goal in this program is to develop the technology for a second-generation reusable launch vehicle (RLV). The RLV studies are named NASA Future-X Pathfinder Flight Demonstrations.

The X-37 is being designed jointly by NASA and the Boeing Company to extend the operating envelope of the related vehicles X-33 and X-34 to include orbital and reentry flight phases. Small enough to be carried to orbit in the space shuttle cargo bay, the X-37 will explore over 36 technologies and experiments including propulsion, thermal protection system (TPS), high enthalpy flight profiles (reentry) and high temperature electronics.

The objectives of the wind tunnel tests 12-0084 and 11-0083 were to acquire low speed and high speed baseline performance data, stability and control data and control surface hinge moment data. Fuselage nose pressure data was also acquired for the calculated air data system (CADS). The tests lasted two weeks at the 12-Foot PWT and three weeks at the 11-Foot TWT. Both tests were conducted on a two shift operation.

The test article was a newly fabricated 16.5% scale model of the X-37 vehicle. It was fabricated by Tri Models of Huntington Beach, CA and was completed at the end of July 2000. The model was first tested at the Micro Craft Low Speed Wind Tunnel (8'X12') in San Diego, CA where initial shakedown and ground plane runs were acquired. *(Please turn to page 7)*

FO OUTLOOK

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FULL-SPAN TILTROTOR AERACOUSTIC MODEL... *(Continued from page 1)*

tiltrotor aircraft is promising in many aspects. The major barrier inhibiting its development is that a tiltrotor aircraft of the size required will likely be too noisy for the surrounding neighborhood. The focus of the FS TRAM project is to determine the locations of primary noise producing areas leading to the further development of quieter civil tiltrotors.

The TRAM team acquired acoustic, blade surface pressure, and wake geometry data on a single isolated rotor model at the Duits-Nederlandse wind tunnel (DNW) in the Netherlands. This test was led by Gloria Yamauchi, TRAM Project Director, and lasted from October 1997 through May 1998. It generated one of the first data sets for locating primary noise producing areas from a tiltrotor. The successful completion of this test allowed the TRAM team to undertake the development of the *Full-Span* Tiltrotor Aeroacoustic Model (FS TRAM), which includes dual rotors and a full aircraft body.

The FS TRAM was installed in the 40x80-Foot Wind Tunnel test section on December 6, 1999, becoming one of the most complex models to be tested here at Ames. There are seven research objectives for the FS TRAM project, including measurements of balance loads, blade structural loads, blade airloads, acoustics, wing pressures, laser light sheet (LLS) and particle image velocimetry (PIV). A large team of civil servants, contractors and students working together has helped the FS TRAM test proceed smoothly for the past year. Several systems were installed both on the model and in the 40x80 for purposes of data acquisition and model functionality. This includes Pressure System Inc. (PSI) modules for static and dynamic wing pressure measurements; an acoustic traverse system used to acquire acoustic data at various streamwise positions; and a pitch mechanism to control the model's angle of attack. Flaperon (flaps and ailerons combined) angle, elevator angle, and pressure blade calibrations were performed in addition to software updates to the NPRIME data acquisition, MFEDS safety-of-flight (SOF) monitoring, and Kaman motor control systems. Acoustic reflection tests, rotating weight tares, rotating aerodynamic tares, drive train balancing and wind-on background noise tests have been performed to prepare the FS TRAM for the acquisition of research quality data.

The FS TRAM, being a highly elaborate model with movable nacelles, elevators and flaperons, requires technical support from various disciplines to keep it maintained and performing optimally. There are eight TRAM sub-teams, each having their own team leader: Gloria Yamauchi leads Acoustics; Bill Szchur, Controls; Tom Burnett, Data Systems; Rich Toner, Instrumentation; Alan Wadcock, LLS/PIV; Mike Derby, Mechanical; and Mike Lopez, Wind Tunnel Operations. The FS TRAM Project Director and Research team lead, Megan McCluer, is responsible for organizing the acquisition of research data and data quality review. These duties work together to make sure that the seven research objectives are accomplished.

These groups often demand concurrent access to the model. Coordination of all model preparation activities are organized by Janet Beegle, FS TRAM Test Manager. Her leadership contributions are essential to increasing the productivity and efficiency of the TRAM team.

Acoustic analysis of the FS TRAM during various flight conditions is an important research objective. These measurements, along with blade airloads, are used to both validate acoustic prediction codes and create a baseline for comparison to other tiltrotor designs. Acoustic research data is taken from twelve microphones located on a plane 1.73 rotor diameters below the rotor blades providing complete measurements across the wing span of the FS TRAM. Reflection tests were performed to locate acoustically reflective surfaces within the wind tunnel test section. An acoustic calibration of each microphone, using a piston phone with known frequency, is performed each day to ensure accurate readings.

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THE 11-FOOT TURNTABLE MODEL SUPPORT... *(Continued from page 3)*

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ARE YOU READY FOR AN EARTHQUAKE? *By Gayle Frank*

"Identify safe places in each office or room..."

Earthquakes strike suddenly, violently and without warning. Identifying potential hazards ahead of time and advance planning can reduce the dangers of serious injury or loss of life from an earthquake. Check for hazards in your home and at your work. Correct these hazards by securing shelves and cabinets to the walls, placing large/heavy objects on lower shelves, and storing breakable items and hazardous materials in low closed cabinets with latches. Identify safe places in each office or room where you can duck and cover, such as sturdy furniture (heavy desk or table), against an inside wall, and anywhere away from glass (windows, mirrors, pictures) or heavy furniture that can fall.

If an earthquake hits, take cover under heavy furniture, cover your face with your arms, and hold on. Stay inside until all shaking is over. The most dangerous thing to do during an earthquake is to try to leave the building because objects can fall on you. Be prepared for aftershocks. Although smaller than the main quake, aftershocks cause additional damage and may bring weakened structures down. If you're outdoors, a safe place during an earthquake is away from buildings, trees, telephone or electrical lines, and overpasses. If you're in a car, stop quickly and stay inside unless you're near buildings, trees, overpasses, or utility wires; then drive to a clear area. Once the shaking has stopped, proceed with caution. Avoid bridges or ramps that might have been damaged.

Be sure to review your earthquake preparedness plan with your family. Include in your plan how to operate a radio for emergency information and how/when to turn off the electricity, gas and water. A relative or friend living out-of-state should be designated ahead of time as a "family contact" for family members separated in any kind of disaster. A pre-arranged location for re-uniting the family after a disaster is always a good idea. There are many web sites which recommend what disaster supplies should be included at your home or in your car.

For more information on earthquake preparedness and suggestions for emergency supplies go to www.fema.gov/library/quakef.htm or www.redcross.org/disaster/safety/earth.html.

FULL-SPAN TILTROTOR AERACOUSTIC MODEL... *(Continued from page 5)*

The LLS/PIV observes blade vortex formation during blade vortex interaction (BVI) conditions. Laser, camera and control hardware were set up for flow visualization measurements. PIV wake measurements are used to measure the vortex velocity field for the vortices visualized during LLS. Dual-vortices observed in tiltrotor wakes are known to greatly complicate the flow field, therefore developing an understanding of the evolution, convection and dissipation of the rotor wake is critical to the prediction of BVI noise.

Monitoring the loads on critical components of the rotors and fuselage during testing is essential for SOF operations. Strain gauges located on the SOF blades (one per rotor) measure flap bending, chord bending, and torsion; while the pressure blades (two, located on the right rotor), measure the lift of each blade. Strain gauges are also located on integral mechanical parts of each nacelle (i.e. pitch and torque links, rotating and stationary scissors, flex beams, etc.). These gauges are monitored during each run so that extreme loads aren't unknowingly applied. In order to determine that all SOF instrumentation was working correctly, each component was calibrated by applying a known load. The recorded limits are then compared to the measurements taken by each strain gauge and displayed as percentages on the monitor front-end data system (MFEDS). MFEDS_L (left) and MFEDS_R (right) are the SOF monitoring stations for structural loads on mechanical components and the SOF blades.

A custom-built rotor control console for the FS TRAM allows an operator to "fly" the rotors during wind-on testing. Major effort is dedicated by the National Full-scale Aerodynamics Complex (NFAC) Controls group to setup, calibrate and ensure it is operating safely.

There are three balances on the FS TRAM, a right and left rotor balance, and a fuselage balance. They allow for unique vehicle studies such as determination of the lift distribution between the rotors and the wings in forward flight. This tiltrotor performance data is unique because it is acquired at a higher resolution and at much steadier conditions than in previous tiltrotor tests.

The data acquisition system, NPRIME, is used to acquire high and low speed data. Data is taken during both calibration runs and test runs. The Data Systems team has to make sure NPRIME is fully functional and recording properly at all times since there is a large amount of high resolution (acoustic and blade pressures) data being collected.

The FS TRAM acquires wing pressure measurements using 185 static pressure taps on the left wing divided into 5 rows across the span of the wing. Three PSI modules were used: one set in the leading edge, the second in a hollowed out section of the flaperon, and the third in the main section of the wing. These determine the lift distribution across the wing.

NFAC System safety, lead by Jim Barnes, has shown continuous involvement in the FS TRAM. Throughout model development, they sought to identify and analyze possible hazards, review procedures and implement training to ensure test safety.

Many years of preparation and months of testing have lead the FS TRAM to the generation of a unique tiltrotor data set. The acoustic results taken from this test can lead to the development of the quiet civil tiltrotor, making the FS TRAM a part of aviation history. It is evident that the combination of dedicated, knowledgeable team members with a motivated and organized approach results in unparalleled success. This kind of success exactly defines the NASA Ames Mission: "To provide world-class products and services that meet or exceed customer expectations."

SECOND ANNUAL SVERDRUP/FO/ASF GOLF TOURNAMENT *By Phil Stich*

Under the always clear California skies, the Second Annual FO/ASF/Sverdrup Technology Golf Tournament was held on September 14 at the Santa Teresa Golf Course in South San Jose. Thirty-six of the top golfers from NASA and Sverdrup took to the links in four-man scramble teams to compete for the coveted Blockbuster gift certificate awards. Tournament Director Tom Bridge used a cunning combination of rules and team assignments to equalize the field and minimize the possibility that Dave Banducci's team would be repeat winners.

The Winning Team - Clockwise from Top Left: Frank Rosal, Ben Reduta, Frank

The competitive intensity was high as shouts of success could be heard across the course. As darkness fell on Santa Teresa, the last foursome of Tom Bridge, Ed Heim, Herb Finger and Mike George had two holes to go, but found that they could actually score better when they couldn't see the target….. in the end it was not enough to carry the day. The team of Luis Cuasay, Ben Reduta, Frank Rosal and Frank Custer (see picture) had bested the field with a one-under-par team score of 70. The top five teams in order of finish were:

Place	Team Score	Team Members
First	70	Luis Cuasay, Ben Reduta, Frank Rosal, Frank Custer
Second	71	Dave Banducci, Pete Zell, Alan Wong, Ev Maynard
Third	73	George Rupp, Rick Giddings, Chris Natividad, Joel Hoffman
Fourth	74	Tom Bridge, Ed Heim, Herb Finger, Mike George
Fifth	75	Phil Stich, Frank Kmak, Steve Ord, Don Bowling

Longest drive honors went to Rick Giddings and Jean Brian. Closest to the pin prizes were awarded to Bob Olgiati, Dave Banducci and Joel Hoffman.

The 2nd Annual tournament was a great success and with a few more rules changes for next year we may yet see Mike George or Phil Stich on the winning team. Many thanks to Tom Bridge for single-handedly organizing and directing this event.

X-37 IN 11FT AND 12FT… *(Continued from page 4)*

The vehicle aerodynamic control surfaces consist of an all flying V-tail or ruddervators for pitch and yaw control, and flaperons for roll and drag control during landing. It also has a speed brake and body flap. Five of the model control surfaces can be operated remotely. The two ruddervators, the two flaperons and the speed brake were designed to be positioned by small Globe motors through a conditioning controller and laptop computer. Potentiometers sensed linkage movement to measure control surface position. The body flap was positioned by manually interchanging brackets for given angles. The right hand ruddervator, right hand flaperon, speedbrake, body flap and the nose gear strut all had strain gages installed to measure hinge moments.

"All objectives were met for the 12 Foot PWT test."

The model was mounted on the high angle of attack (HAA) model support at the 12-Foot. The model was tested through an angle range of –4° to 20° angle of attack and ±10° of sideslip angle. The desired Mach number and tunnel total pressure could not be attained due to strut/model dynamics. Data was acquired at a slightly lower M and pressure. At the end of the primary phase of the test, a higher capacity balance was installed and the desired conditions were attained. A maximum Mach=0.5 was run for comparison with the 11-Foot. A total of 240 runs were acquired at the 12-Foot PWT at an overall run rate of 1.9 runs per user occupancy hour (total occupancy less facility down time) and 9.5 runs per drive hour.

After the 12-Foot test, the model was disassembled. It was rebuilt on a different sting for mounting on 11-foot model support system (knuckle-sleeve). The test at the 11-Foot TWT operated through an angle range of -8° to 18° angle of attack and ±10° sideslip angle. Tunnel conditions were transonic Mach numbers up to M=1.4 at two atmospheres. At the 11-Foot TWT a total of 700 runs were obtained. The original test plan was scheduled for 900 runs however this was based on a highly optimistic run rate. The actual rates were 4.0 runs per user occupancy hour and 6.5 runs per drive hour.

All objectives were met for the 12 Foot PWT test. Although the desired number of runs was not acquired at the 11Foot TWT, data was acquired for all planned configurations. Data included stream angle runs at the 12 Foot and continuous sweep data for the 11 Foot. Continuous sweep data acquisition needs more development to get high quality data. Infrared camera visualization was used to see transition and shock reflections on the ruddervator.

Employees of the Month

Both Abraham Seyoum and Dan Malmgren demonstrated their technical knowledge and project management skills by assuming direct responsibility for two C and F electrical projects. The two FO projects were the T-45 and the T-46 Grounding Transformer Replacement, and the Control Voltage Battery Replacement in the Unitary Switchyard. The FEF Project was the replacement of Oil Circuit Breakers with SF 6 Circuit Breakers. The successful completion of all three of these projects were critical to the Unitary's ability to proceed with the X-37 testing as scheduled. Abraham and Dan provided technical interface and review during the design phases of all three concurrent electrical projects. Additionally, they provided program integration and management skills creating a successful plan for accomplishing all three projects concurrently. Both Dan and Abraham were consistently required to go beyond the scope of their own responsibilities , provide submittal reviews, technical coordination, and construction management across all three projects. In addition, Dan and Abraham created and supervised an integrated testing plan when the FEF, JFP, and EPRO proved unable to accomplish this critical safety responsibility. Therefore both Abraham Seyoum from code FOF and Dan Malmgren from Sverdrup are Employees of the Month for September 2000.

Gary Sorlien is being honored as August Employee of the Month for his outstanding accomplishment that brought the NPRIME data systems program to stable operation. Through his structured approach, Gary and his staff systematically isolated and attacked each of the multitude of problems associated with NPRIME 2.0.1. Gary was personally responsible for investigating and repairing the "sync loss" problem, which has plagued the TRAM for several months. His task was significantly complicated by the fact that he had to learn the VxWorks operating system and working through someone else's code to resolve problems in their software. Gary's repair has had a significant positive effect on NPRIME reliability. His repair also helps FOI's ability to respond and recover more quickly with future problems.