NASA Publishes Book On Light Aircraft Design

A three-volume report of literature relevant to the design of light aircraft has been made available to general aviation manufacturers by the National Aeronautics and Space Administration.

NASA aeronautical research, although originally performed in support of commercial and military aircraft, can be very useful to general aviation, particularly since the speed of light aircraft has now reached the point where military and commercial aircraft have operated for several decades.

However, general aviation manufacturers are usually small compared to other aerospace manufacturers, and lack the large engineering staffs needed to adapt new technology rapidly. NASA realized this problem and contracted for approximately 10,000 aeronautical documents to be organized, catalogued, and evaluated.

Material found pertinent to the design of light aircraft is presented in the form of abstracts. The catalogued abstracts are appendices to the report, the main body of which is a series of studies discussing the content, quality, detail and value of the literature reviewed.

Information is made available in the areas of structural design, propulsion sub-systems, landing gear loads, flutter, refined performance calculation procedures, and high horsepower propellers.

The report is called “A Study of NACA and NASA Published Information of Pertinence in the Design of Light Aircraft,” (Volumes I, II and III) and may be obtained from the National Technical Information Service, Springfield, Va., 22-151. Single document price is $3 (microfiche is 65 cents).

FUTURE DESIGNS: This drawing shows how a standard F-8 could be modified by either moving or reducing flight controls to end up as a Control Configured Vehicle (CCV).

Fly-By-Wire Program To Begin

Technology and equipment used to guide the Apollo spacecraft will now be used by the Flight Research Center to aid designers in improving the performance and flying qualities of future aircraft.

A digital computer and associated equipment built for the Apollo Lunar Module will be installed in a modified jet fighter for flight tests to be conducted by the Center. The computer will serve as the basic computation element for a complete fly-by-wire flight control system that will be tested on a modified Navy F-8.

(Next Column)

COVER:

Three lifting body chase aircraft, two F-104’s and a T-38 in the center, roar over the M2-F3 lifting body in salute following a recent flight. The M2 is now involved in a flight envelope expansion program that will take it to increased speeds and altitudes under rocket power.

Studies conducted during the past 10 years by both government and industry indicate that fly-by-wire flight control systems offer significant advantages over mechanical control systems. These advantages include reduction in weight, maintenance volume, and cost and increases in reliability.

These advantages are particularly applicable to large vehicles or high performance vehicles such as the advanced transport and proposed space shuttle.

According to project engineer Mel Burke, the acceptance of a fly-by-wire flight control system may permit the design of a future type of aircraft called the Control Configured Vehicle (CCV).

Because the fly-by-wire control system could electronically provide the necessary flight stability, it might be possible to reduce the size of the large structural components such as tail surfaces and (Continued on page 5)
Contrails:

Former X-15 pilot Bob Rushworth is now Director of Flight Test at Wright-Patterson AFB. . . . Meryl DeGeer, Flight Operations, was married on Valentine's Day which prompted perennial bachelor Bill Albrecht to say, "If marriage is such a good deal, how come Cupid never got married?" . . . A bachelor party for Meryl was hosted by her best man, Herb Anderson and featured an educational lecture by Flight Operations engineer Bob Baron. . . . Ken Szalai, Research, was omitted from the list of members of the Credit Committee in the previous X-Press. . . . Debbie Sweatt, Personnel, is engaged. Several of the co-ops are sad. . . . Clint Johnson is the new Cost Reduction Officer and E. H. "Mort" Mortensen is the new Center Pollution Control Officer which ought to cancel his invitation to post-flight parties. . . . Brenda Harris, Research, won second place in a talent show held at the Citizens Band Radio National Jambo-ree in Yuma, Arizona. She yodels. . . . Judging by the freshly baked cakes being brought to work, there's going to be a new McMurtry. It seems that whenever the wife of Tom McMurtry, Pilot's Office, is expecting, she can't sleep all night long. So she gets up and bakes cakes. . . . Bruce Peterson, Research, has been promoted to Lt. Col. in the USMC reserves. He is a helicopter pilot in the active reserves. . . . John Manke, Pilots Office, will present a paper on the lifting body flight program at the AIAA's Space Shuttle Technology Conference in Phoenix, Arizona. . . . Friends held a surprise birthday party for Gene Kotchick, Procurement. . . . Bill Dana's Think Pink curse has struck again. Newest victim is Vince Capasso, Operations Engineering, with a new baby daughter.

Employees Exchange Association News

According to Association Vice President Archie Moore, there are funds available to assist various Center divisions in sponsoring social gatherings. Interested persons should contact Archie or any other EAA representative.

The sports committee chairman would like to know if there is enough interest in playing volleyball to schedule time at the local gymnasium. If you are interested, please contact Don Black, ext. 567.

Discount tickets for the Palm Springs Aerial Tramway are available from Patti Apprill, room 1017.

EAA social chairman Terry Putnam has formed his committee with Leroy Frost, Office of the Director; Jay King, Flight Operations; Wilson Vandiver, Data Systems; and Wally Sefic, Research. In addition to assisting in the planning and execution of the traditional dances and picnic, the committee is eager to expand their efforts. Employees are encouraged to submit new ideas to any of the committee members.

Suggestions for new items to be sold by the Exchange Store should be given to Archie Moore, ext. 263.

From time to time certain items in the Exchange Store are sold at a discount. Announcements of these special prices will be posted on the cafeteria door. The Exchange Store is in the process of expanding its inventory. New items arriving shortly include 14kt gold Cross pen and pencil sets; L-1011, L-2000 SST, and DC-10 tie tacs and charms; Apollo 14 medallions, and an Apollo series of embroidered cloth patches. New Disneyland MKC cards for 1971 arc now available in addition to Sea World, Japanese Deer Park and African Safari.

NASAL ACCESSORY: A new installation in the cockpit of the PA-30 provides relief and comfort for project pilot Einar Enevoldson's sinus condition. It also saves on handkerchiefs.
FIRST FLIGHT: The F-8/SCW made its first flight following four months of preparation at the Center.

NASA SCW Makes First Flight

The Upside-Down-Wing made its first flight earlier this month. Center research pilot Toni McMurtry reported that the modified F-8 with its supercritical wing handled extremely well during its 47 minute flight.

Because of its lengthy take-off and landing roll, the supercritical wing used Rogers Dry Lake bed for the first flight. Future flights will use the hard surface runway at Edwards.

The first flight was an operational check of the aircraft and its various systems. Maximum speed and altitude were limited to approximately 350 mph and 10,000 feet.

The supercritical wing was developed at NASA's Langley Research Center, Hampton, Virginia, in a wind tunnel program under the direction of Dr. Richard T. Whitcomb. These tests indicated that the new airfoil shape could allow highly efficient flight near the speed of sound approximately 660 mph at cruising altitudes.

If the performance measured in the wind tunnel can be achieved in flight, it should be possible for future aircraft to cruise at the higher speeds with no increase in fuel consumption. This advantage could be converted into increased range and/or, by carrying less fuel, greater payload resulting in lower operating costs per mile.

The prime purpose of the flight test program is to verify the wind tunnel predictions and to explore the operational potential of the supercritical wing in flight.

Almost directly opposite from conventional airfoil shapes, the supercritical wing has a flattened top surface. This delays the speed of the air flowing over the upper wing surface from reaching supersonic speeds until the airplane itself is flying at a higher speed. It also moves the shock wave near the back of the wing and increases the total wing efficiency.

To compensate for some loss of lift that results from flattening the top of the wing, the rear portion of the lower surface has been shaped in the form of a concave curve.

At cruise speeds of modern day jet transports, approximately Mach 0.8 or about 530 mph at a cruising altitude of 35,000 feet, the air flowing over the curved upper surface of the wing reaches supersonic speeds. This results in local shock waves on the wing that cause a sharp rise in aerodynamic drag and a significant decrease in efficiency.

The flight test program has been initiated to provide a means for demonstrating the high force-break Mach numbers indicated in the wind-tunnel tests and for establishing the desired level of confidence in predictions for future application. It will also investigate the maneuvering and speed margins and the stability and control characteristics of the supercritical wing aircraft under normal and off-design conditions, as well as the problem associated with lateral control devices and contour variations.

PROJECT PILOT: Tom McMurtry is the project pilot and made the first flight of the supercritical wing.
relocate others. This would reduce the basic weight and drag of the aircraft and offer increased performance and better handling qualities.

On the NASA fly-by-wire flight control system, control inputs from the pilot are fed electronically through an interface to the digital computer which has been programmed with several different types of control modes or logic. The particular mode is selectable by the pilot. An inertial measuring unit, also obtained from the Apollo Program, feeds information about the aircraft’s flight environment to the computer.

The computer uses the flight information to assist in the conversion of the pilot’s inputs into the proper electronic commands that are actually sent to the airplane’s control surfaces. Upon receipt of the commands, small actuators hydraulically move the control surfaces.

The bulky conventional F-8 control system consisting of cables, bell cranks, and other mechanical equipment will be removed from the test aircraft. A secondary system utilizing three separate fly-by-wire control channels will serve as back-up.

Up to this time, fly-by-wire aircraft control experience has been limited to analog computers and pseudo fly-by-wire systems such as in the auto-pilot of the British/French Concorde. The NASA F-8 program will be the first to utilize a digital type of computer and the first to fly without a mechanical control system as back-up. The digital type of computer was selected because of the increased flexibility as determined in earlier Apollo studies.

The entire NASA fly-by-wire flight control system should be installed in the modified F-8 by next fall and operational by the following spring. A second F-8 will be modified to serve as a ground based simulator at the Flight Research Center.

(Copy-By-Wire Continued)
Employees Benefit Assoc. Holds Enrollment Drive

NASA Employees Benefit Association is proud of the fact that it is able to offer life insurance, with double indemnity for accidental death, for a quarterly payment of $1.30 per thousand. Obviously, this amounts to an annual premium of $5.20, or 10 cents per week per thousand dollar coverage. This amount is the same for all eligible employees regardless of age. The schedule of insurance is as follows:

<table>
<thead>
<tr>
<th>Description of Class</th>
<th>Life Insurance Face Amount</th>
<th>With Accidental Death Benefit</th>
<th>Employees' Quarterly Payment*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>$8,000</td>
<td>$16,000</td>
<td>$10.40</td>
</tr>
<tr>
<td>Class 2</td>
<td>$10,000</td>
<td>$20,000</td>
<td>$13.00</td>
</tr>
<tr>
<td>Class 3</td>
<td>$12,000</td>
<td>$24,000</td>
<td>$15.60</td>
</tr>
<tr>
<td>Class 4</td>
<td>$14,000</td>
<td>$28,000</td>
<td>$18.20</td>
</tr>
<tr>
<td>Class 5</td>
<td>$16,000</td>
<td>$32,000</td>
<td>$20.80</td>
</tr>
<tr>
<td>Class 6</td>
<td>$18,000</td>
<td>$36,000</td>
<td>$23.40</td>
</tr>
<tr>
<td>Class 7</td>
<td>$20,000</td>
<td>$40,000</td>
<td>$26.00</td>
</tr>
<tr>
<td>Class 8</td>
<td>$22,000</td>
<td>$46,000</td>
<td>$29.90</td>
</tr>
<tr>
<td>Class 9</td>
<td>$24,000</td>
<td>$50,000</td>
<td>$32.50</td>
</tr>
<tr>
<td>Class 10</td>
<td>$26,000</td>
<td>$54,000</td>
<td>$35.10</td>
</tr>
<tr>
<td>Class 11</td>
<td>$28,000</td>
<td>$60,000</td>
<td>$39.00</td>
</tr>
<tr>
<td>Class 12</td>
<td>$30,000 and over</td>
<td>$70,000</td>
<td>$45.50</td>
</tr>
</tbody>
</table>

* Changes in the class of insurance in accordance with the above Schedule of Insurance will be effective on the first day of the calendar quarter following the date of the change in the employee's base annual pay.

Participants in the plan may also obtain insurance coverage on their spouses and children, if they so desire. Not only is it rather unusual to be able to obtain dependent coverage under a group plan, but also the rates are very low. The quarterly premium payment is the same amount, regardless of the number of children covered, or the age of the spouse. In addition, this policy has a guaranteed insurability option, so that so long as you remain insured with respect to your dependents, the option assures the availability of $5,000 of cash value life insurance to each dependent child when he reaches age 19, regardless of his health, occupation, or military status at that time. Even in the case where there are no children and only the spouse is covered, the cost is about $1.00 per thousand per quarter and, of course, is much less if children are also covered.

<table>
<thead>
<tr>
<th>Description of Class</th>
<th>Life Insurance - Face Amount</th>
<th>Employees' Quarterly Payment**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A</td>
<td>$2,500</td>
<td>$2.65</td>
</tr>
<tr>
<td>Class B</td>
<td>$5,000</td>
<td>$4.65</td>
</tr>
</tbody>
</table>

* 14 days to 6 months - $100 coverage provided; $1,000 from 6 months to 19 years.
** Net cost may vary from year to year based on dividends earned.

This insurance is available to all NASA employees occupying full-time positions and serving under other than a temporary limited appointment, within 90 days of the date of employment, without question. However, for those employees who did not obtain this insurance during their first 90 days of employment, it is still relatively easy for most to get the coverage now. They must complete a health questionnaire, showing evidence of insurability satisfactory to the Home Life Insurance Company. In doubtful cases, the company may request further medical information from the applicant's personal physician or, in rare cases, that he obtain a medical examination. The time to apply for life insurance is while you are still in good health. We never really know when we might develop a medical condition which will prevent us from obtaining any insurance protection or, at best, will cost us a sizeable extra premium.