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SCANNERS, OPTICAL CHARACTER READERS, CYRILLIC ALPHABET AND RUSSIAN TRANSLATIONS

Final Report
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REFERENCES

1. *Access to Space*. NASA Advanced Technology Team (Option 3), Volume 3. Final Report. 1993.

2. Engelund, W. "SSV-001, 6-DOF Aero Database." Preliminary Aerodynamic Database. March 1994.

3. Hoak, D. E. et al. "USAF Stability and Control DATCOM." Data Compendium, 1978.

4. Lan, C. E. and J. Roskam. *Airplane Aerodynamics and Performance*. Roskam Aviation and Engineering Corporation, Ottawa, Kansas, 1988.

5. Lepsch, R. "Weight Statement - Level III, Unmanned SSV, Duel-Fuel, RD-701." Data Table, April 1994.

6. Rockwell International. "Operational Aerodynamic Data Book, Orbiter Vehicle Aerodynamic Data, Volume 3." Rockwell International, 1985.

7. Rockwell International. "Space Shuttle Ascent GN&C Data Book Appendix." Contract NAS9-18500. September 1992.

8. Roskam, J. *Airplane Flight Dynamics and Automatic Flight Controls*. Roskam Aviation and Engineering Corporation, Ottawa, Kansas, 1982.

9. Springer, A. "Initial Ascent and Entry Aerodynamic Database for the Wing/Body 001 (WB001) Reusable Launch Vehicle (RLV) Configuration." Memorandum, July 1994.

INTRODUCTION

A winged-body, single-stage-to-orbit (SSTO) vehicle is under evaluation as a candidate to serve as the next generation space transportation system. Intended to service International Space Station Alpha, and with a payload capability roughly equivalent to the current shuttle system, SSTO configuration WB001 (winged-body 001) represents the best ideas from emerging technologies, experience with the Space Shuttle system, the National Aero-Space Plane studies, and the Single Stage Rocket Technology study.

Engineers at Langley Research Center (LaRC) have developed a preliminary aerodynamics database and weight estimates. Team members at Marshall Space Flight Center (MSFC) lead the effort and have contributed preliminary mission parameters and initial vehicle geometry. One of Johnson Space Center's (JSC) tasks involved analyzing descent-to-landing trajectories using the Shuttle Engineering Simulator (SES). This effort currently focuses on the last eighty plus seconds of the flight (10,000 feet to the runway).

Review of LaRC's aerodynamic information indicates static lateral instabilities in the yaw and roll moment derivatives, and suggests a more comprehensive static stability analysis. Next logical steps include determination of possible longitudinal and lateral-directional trim points. This should assist in trajectory design by providing an initial 'point of departure' from currently-modeled shuttle orbiter mission profiles. A study was also accomplished to improve vehicle lateral stability (increase $C_{n\beta}$), concentrating on increasing size of the tip-fin control surface.

Static vs. Dynamic Stability

Aircraft static stability is determined by analyzing forces and moments generated by vehicles in response to a perturbation. This change in force or moment coefficient to a given input (∂Force/Moment Coefficient/∂Motion) is called a stability derivative. A set of generally recognized rules specifies the sign (positive or negative) the derivative's value must have for static stability. It is important to recognize static stability is not a requirement. Most modern

ABSTRACT

Three NASA centers: Marshall Space Flight Center (MSFC), Langley Research Center (LaRC), and Johnson Space Center (JSC) are currently involved in studying a family of single-stage- and two-stage-to-orbit (SSTO/TSTO) vehicles to serve as the next generation space transportation system (STS). A rocketed winged-body is the current focus. The configuration (WB001) is a vertically-launched, horizontally-landing system with circular cross-section. Preliminary aerodynamic data was generated by LaRC and is a combination of wind-tunnel data, empirical methods, and Aerodynamic Preliminary Analysis System- (APAS) generated values.

JSC's efforts involve descent trajectory design, stability analysis, and flight control system synthesis. Analysis of WB001's static stability indicates instability in 'tuck' ($C_{mu} < 0$: Mach = 0.30, $\alpha > 3.25°$; Mach = 0.60, $\alpha > -8.04°$), an unstable dihedral effect ($C_{l\beta} > 0$: Mach = 0.30, $\alpha < 12.00°$; Mach = 0.60, $\alpha < 10.00°$), and, most significantly, an unstable weathercock stability derivative, $C_{n\beta}$, at all angles of attack and subsonic Mach numbers.

Longitudinal trim solutions for Mach = 0.30 and 0.60 indicate flight path angle possibilities ranging from around 12 (M = 0.30) to slightly over 20 degrees at Mach = 0.60. Trim angles of attack increase from 6.24° at Mach 0.60 and 10,000 feet to 17.7° at Mach 0.30, sea-level. Lateral trim was attempted for a design cross-wind of 25.0 knots. The current vehicle aerodynamic and geometric characteristics will only yield a lateral trim solution at impractical tip-fin deflections ($\approx 43°$) and bank angles (21°).

A study of the lateral control surfaces, tip-fin controllers for WB001, indicate increased surface area would help address these instabilities, particularly the deficiency in $C_{n\beta}$, but obviously at the expense of increased vehicle weight. Growth factors of approximately 7 were determined using a design $C_{n\beta}$ of 0.100/radian (approximate subsonic values for the orbiter).

ABSTRACT

The writing of code for capture, in a uniform format, of bit maps of words and characters from scanner PICT files. The coding of Dynamic Pattern Matcher for the identification of the characters, words and sentences in preparation for translation.

INTRODUCTION

There are many commercial software language to language translators available, however there does not appear (as of June,1994) to be any that translate from Russian to English. A search revealed that there was no commercially available optical character reader (OCR) for the Cyrillic alphabet.

There are several difficulties encountered in attempting such translations. The very first is the capture and identification of characters of the Cyrillic alphabet, that has several unusual characters as well as a large character set. The task is not lessened by the appearance from place to place in the text of non Cyrillic characters as well as the occasional diagram. After having identified the characters, or at least some high percentage of them, the next task, which is considerably larger, is the translation of the words identified into English in a fashion that is unstilted as well as accurately representing the meaning of the original text. The need for such software is clear in view of the cooperative venture, space station.

DISCUSSION AND RESULTS

The work this summer produced software that will, from PICT files, identify characters and words. The pattern recognizer employed is the dynamic pattern matcher (DPM) developed earlier by the author and his NASA colleague. The code for the translation of the found words has not been done, but it has been observed that scientific Russian lends itself to translation much more readily than, for example, articles on philosophy.

The overall plan is to have the documents scanned and stored. The user would then view the scans of the documents at a terminal and select, with the aid of a 'mouse', those portions that are to be translated. These portions maybe entire pages or parts thereof. After having selected the material that is to be translated, the user turns control back to the machine. The machine begins it work, usually during the overnight period when there are several machines (SUNS)

that are not in use. If the amount to be translated is small, say a few paragraphs, then it could be processed at that time.
Using parallel virtual machine (PVM), a software package we obtained from Oak Ridge National Laboratory (ORNL) where it was developed, unused machines (SUNS) are linked during the overnight period to form a large parallel machine. Mr. David Merritt has implemented PVM on a collection of our (SUNS). PVM should provide for rapid processing of the portions selected for translation. The use of a large array of machines obviously allows the use of large data sets for the identifying of characters and words as well as the processing power of the many processors.
The idea is to have character sets and a dictionary on line so that if a particular character is unrecognizable, then the remaining characters in conjunction with the dictionary will help determine the unresolved character. This will be then noted and during translation a decision will be made to determine, using the context in which the word in question is used, if the correct character, and hence word was used. This will not be seen by the user unless the matter in question cannot be resolved. In that instance the end user will be presented, in braces in order of preference, a list of possible alternatives for the questionable word or phrase. The result is that recognizing characters is closely tied to the translation to be made and not a separate process.
Text with embedded diagrams is dealt with by the determination of regions of non text items, using such statistics as average line height, line spacing and average character width. These regions are then isolated and the remaining portions are then processed. Diagrams are returned unprocessed. However, if a portion of a diagram has text and that text is selected by the user, it will be processed.
The machines will report back the next day with the results. The results reported will have the appearance of the original document as to position and font size, but in English. Should there be additional portions of the text that require translation or newly added text, the process maybe repeated.

CONCLUSIONS

It has been reported that several governmental agencies have been working on this problem for many years, which is an indication that

the general problem is quite difficult. Our hope is that the documents to be dealt with are all of a scientific nature, which we have already noticed are considerably easier to process. A second point is that even if the translations produced are not highly accurate, they should provide sufficient information to decide if the material deserves a precise, but costly, manual translation.
The search for such an OCR that can deal with the Cyrillec alphabet and a Russian to English translator has continued throughout the summer. During the first week of August a new software package has been released by a small group located in California for Russian to English translation as well as, at least claimed to be, a perfect Cyrillic OCR. During the second week of August we obtained a copy of each for evaluation and testing. The translator package 'Stylus' by Project MT Ltd., the OCR package 'Cuneiform' by Cognitive Technology, Cyrillic font set 'ParaWin+fonts' by ParaGraph International and finally a Russian dictionary 'Propis' by Agama. These software packages were supplied by Russian Business Services, Inc of Houston, Texas.

Section 17 not used.

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NUMERICAL SOLUTION OF DIFFERENTIAL EQUATIONS BY ARTIFICIAL NEURAL NETWORKS

Final Report

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