THE DEVELOPMENT OF UTILITY MOTORGLIDERS IN CHINA

by Ruying Zhang, Baokui Shou and Kuiwen Chen, China

Presented at the XXIII OSTIV Congress, Borlänge, Sweden (1993)

1. INTRODUCTION

Motorgliders in China(l) were prepared initially for sports and later for broader usages. Actually the whole 1980's decade was devoted to the development of utility motorgliders of the types PETREL & SEAGULL. In a developing country, like China, where sport flying is not yet affordable to the public, it is more appropriate to make the motorgliders serviceable for utility purposes.

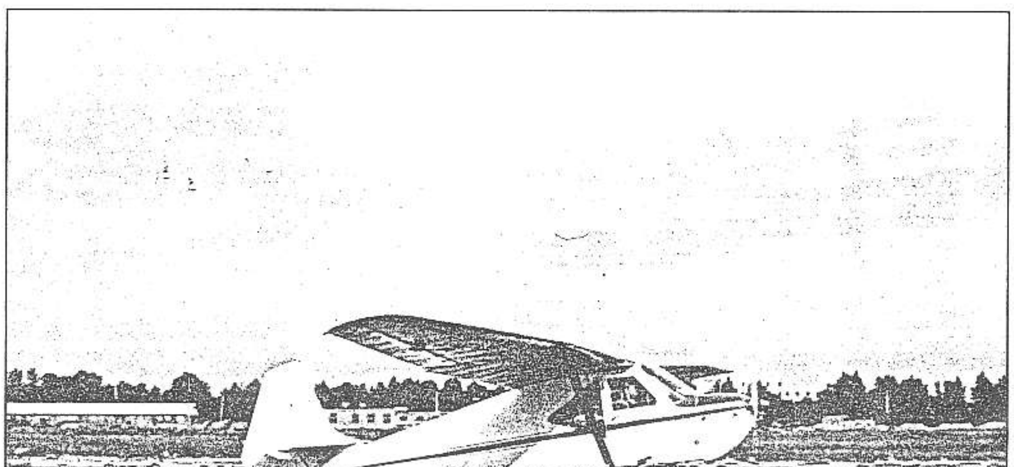

FIGURE 1. The PETREL, 650C.

2. LOOKING FOR NEW SYSTEMS FOR AERIAL EXPLORATION

Mr. Shou started in 1979 to search for an ideal combination of instrumentation, aircraft and methods for aerial exploration such as radioactivity and magnetic exploration. Aerial exploration had been done with airplanes such as the Yun-5 and Twin Otter, but these aircraft were expensive and limited to exploration of flat areas. A large area of China has hills and mountains. A new system of instrumentation had to be developed to meet the requirements of being reliable, automated for repeatable and controllable data acquisition, and very light to suit a light plane. Extensive studies and experiments were carried out in both fields. In this paper, only the work on the aviation part is reported.

At first, the feasibility of using airships were considered. In China, we have had hot-air airship and hydrogen filled experimental airships (helium filled airships appeared later). They were found to be too slow and poor in maneuverability, and they need ground support facilities.

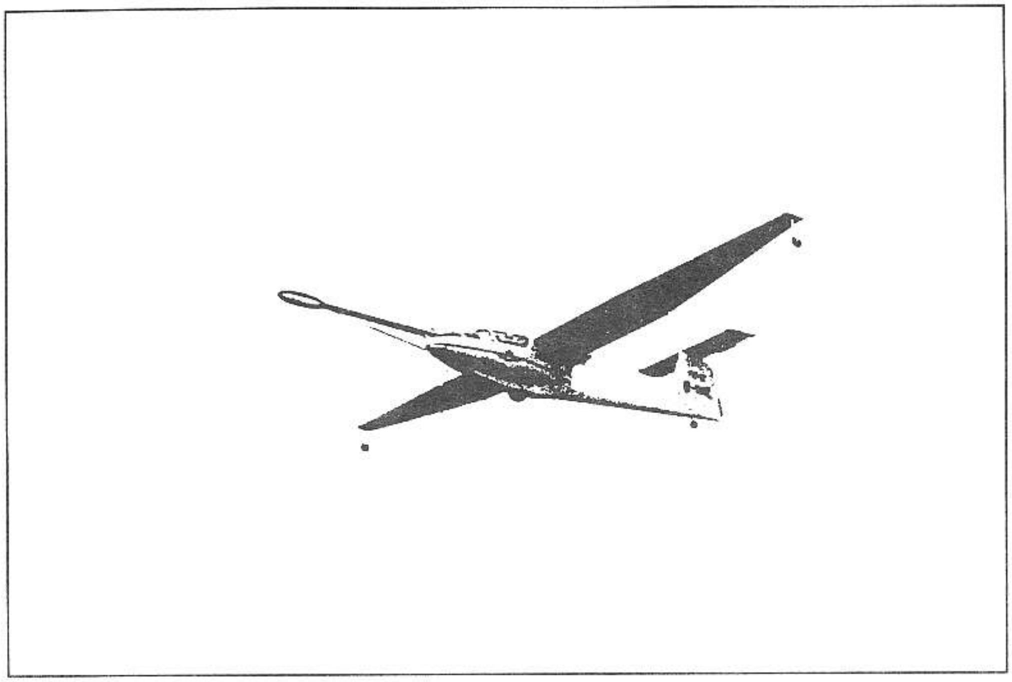

FIGURE 2. The SEAGULL SU-1, with the sensor mounted in front, far away from the metal construction.

for an aircraft for exploration, which was developed by the Shenyang Sailplane Factory. The first prototype, PETREL 550, with a complete newly developed instrumentation mounted in the cabin and a sensor for magnetic exploration mounted at the wooden wing tip far away from metal parts, was put in operation by Mr. Shou in 1985 over a hilly district to work for radioactivity and aero-magnetic exploration. This new system included not only new hardware but also new methods of data acquisition. Since the PETREL had to be piloted with VFR navigation, an accurate map was first prepared by taking a series of map making photography pictures with a special camera on board an ultralight aircraft MIFENG 3. Then maps with scales of 1:2,000, 1:5,000 and 1:10,000 were made for the district of exploration. On these maps, lines of parallel flying courses for the PETREL were drawn, and the pilot made careful preparations to familiarize himself with the landmarks on the courses before each flight. There was a color video camera on the plane which looked vertically downward, and recorded the location simultaneously with the magnetic data acquisition. With this complete combination of systems, a total of 600 hours and 20,000 kilometers of aerial exploration were completed with great success – new abnormalities were found which led to the discovery of large mineral deposits of copper and gold. This combination of systems was very cheap, efficient, accurate and reliable, and resulted in good quality of exploration work. Later it was used for geophysical exploration and remote sensing(4).

Later, PETREL's aircraft were developed to carry more weight and other improvements. A PETREL 650B was bought by the Surveying Group of Shanxi Province(5) in 1990 to work over Qinling district which has high mountains with good success in low level large scale remote sensing photography and aero-magnetic surveying. This type of motorglider was also used by other operators for aerial photography, surveying for city management, patrol for pipeline and power line, etc. The fuselage of the PETREL 650C has been redesigned to be more roomy for bigger cameras and for another person for controlling the system. It can carry 4 persons. The latest model of PETREL is the 650D with 4 seats, metal wing with the same planform and airfoil, 116 hp engine and a TOW of 1050 kg.

The SEAGULL SU-1, an all metal pusher type motorglider of 116 hp and TOW of 1050 kg, is also very good for such

Subsequently, the SY-5 was designed and built by a team at Beijing Aeronautical Institute. It was quite impressive with its foldable soft wings (ease for transportation) and its low altitude flying features. Two prototypes were built, and the first was flown in October 1981. It had a wing area of 32 m , powered by a 72 hp Limbach SL 1700EBI engine, and had a TOW of 500 kg. Further test flights were made and a demonstration was made in 1982, during a symposium in Nanjing. The rate of climb was not satisfactory, showing that an aircraft of higher aspect ratio would have been better.

Then, the D-4 was developed by the RPV Research Institute of Northwestern University of Technology. It could make good pictures with no pilots on board. It had been used by the surveyors in Xian for flexible work on small areas.

The fourth trial was to test in flight a set of visible and infrared CCD camera mounted on an imported SF-28 motorglider in September, 1982. Since the cockpit for the second pilot was limited and holes were not allowed to be made, we mounted the instrumentation outside along the fuselage. Several flights were made with very good and accurate results. This type of aircraft was found to be stable and the errors in the data obtained were well within the tolerances.

The fifth attempt was to test in flight a set of newly developed instrumentation with high automation, new integrated circuits, energy saving and of light weight, on a SJ-6 (mass produced, 2 seat tandem trainer of 285 hp) in 1983. Unfortunately, the SJ-6 was not ideal with its long take-off and landing distances, and high fuel consumption.

3. EXPERIMENTS WITH PETREL & SEAGULL

All the aforementioned attempts led to the specifications systems combination. GPS has been adopted for navigation. It had accumulated 500 hours, 44,000 line-km in 1989, and 200 hours, 20,000 line-km in 1990-91 in exploration for oil and gas. It is also used for many other missions by BGRINI(4). The SEAGULL is very useful because it can fly for 7 hours achieving 800 line-km with 180 liters of fuel in one day at a cruising speed of 160 km/h. The sensor is mounted in front of the nose in a fiberglass FRP tube and streamlined body mounted at an adequate distance away from the metal construction.

4. EXPERIENCES WITH MOTORGLIDERS

Motorglider, being capable of gliding with a ratio of 1:12 (PETREL) and 1:20 (SEAGULL HU-I) or higher, are much safer in case of an engine failure because they can glide away from a crowded area of operation with enough height, and are very economical to operate because of lighter construction, lower fuel consumption and longer duration.

A successful design is achieved by close cooperation between designer, user, and manufacturer.

5. REFERENCES

(l) Zhang, Ruying, Ma, Longzhang: China's Sailplane & Motorgliders - An Overview.

(2) Zhang, Ruying: Wang, Chongming: A Study on Serial Model Program of Light Airplanes, presented on TCLFV, CSAA Symposium 1985.

(3) Feng, Dihuan: Present Status and Expecting Development of the Applications with Motorgliders, presented on TVLFV, CSAA Symposium 1992.

(4) Jiao, Zhangming: A Brief Introduction of the Experiment and Application of Remote Sensing and Aerial Photography with Light Aircraft, presented on TCLFV, CSAA Symposium 1992.

(5) Li, Yanggui: A Study on the Practice of Low Level Large Scale Remote Sensing Photography and Aero-magnetic Surveying with Light Aircraft PETREL 650B, presented on TCLFV, CSAA Symposium 1992.

ANTHROPOMETRY AND GLIDER COCKPIT DESIGN

In the above-titled paper, by Dr. Anthony M. Segal, published in Volume 18, Number 1, the following errors occurred in transposing the original tabulated data.

In Table 1, 10 percentile stature should read 1693.7mm; 60 percentile sitting height should read 943.7mm; 15 percentile buttock-knee length should read 579.2mm.

In Table 2, 95 percentile bideltoid breadth should read 458.5mm.

For convenience of use of Table 2, readers may care to write in the buttock-knee length values from the last column of Table 3, remembering that they were dervied as described in the text.