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AFMDC-TR-63-9
Technical Report

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~~(S)~~ VOSTOK SPACECRAFT RETROFIRE AND DEORBIT SYSTEMS

DECEMBER 1963

TASK 618204(3.3.8.3)

AIR FORCE MISSILE DEVELOPMENT CENTER

DEPUTY FOR FOREIGN TECHNOLOGY

AIR FORCE SYSTEMS COMMAND

HOLLOMAN AIR FORCE BASE

NEW MEXICO

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FOREIGN TECHNOLOGY REPORT

AFMDC-TR-63-9

(Title Secret)
VOSTOK SPACECRAFT RETROFIRE
AND DEORBIT SYSTEMS

December 1963

Task 618204(3.3.8.3)

Prepared by:

Captain William J. Barlow

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DEPUTY FOR FOREIGN TECHNOLOGY
AIR FORCE MISSILE DEVELOPMENT CENTER
AIR FORCE SYSTEMS COMMAND
HOLLOMAN AIR FORCE BASE, NEW MEXICO

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PREFACE

The information reflected in this report has been prepared primarily for the use of Foreign Technology personnel engaged in the analysis of the Soviet space effort. Captain James W. Zimmer provided significant research and contributions to the material in Section IV concerning orientation systems. The study of the Soviet space effort is an Air Force Systems Command project, and this report will be of particular interest to individuals concerned with Soviet deorbit, retro-thrust, and re-entry techniques. This is a technical support document for Project 6182, Task 618204(3.3.8.3), assigned to the Air Force Missile Development Center.

PUBLICATION REVIEW

This Foreign Technology document has been reviewed and is approved for distribution within the Air Force Systems Command.

FOR THE COMMANDER

Howard L. Conkey

HOWARD L. CONKEY
Lt Col, USAF
Deputy for Foreign Technology

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(U) SUMMARY

Purpose

This report was prepared to satisfy requirements established by the Foreign Technology Division Vostok Technical Operational Project Specification (TOPS). These requirements are reflected on page 47 of the TOPS as Task 618204(3.3.8.3). (S)

Conclusions

The following conclusions are presented:

a. A decision to deorbit a vehicle is made by the Moscow Mission Control Group based on degree of mission accomplishment, the cosmonaut's recommendations, and orbital parameters determined by the space tracking net. (S)

b. Ground commands are passed to the Vostok electronic programmer, possibly via a highly directive radar link from either Kamchatka or the Tyura Tam rangehead on the recovery orbit. These commands are likely in the form of precision times for automatic activation of deorbit events; the cosmonaut will monitor and verify the automatic sequence. The Soviet Space Event Support Ships (SSESS) also monitor the deorbit phase and could be utilized in the deorbit command link. (S)

c. There is a separate automatic deorbit orientation system aboard the Vostoks which utilizes a sun sensor, gyros,

and horizon scanners. Three gyros and three actuators are utilized with the following mechanization affording the greatest precision and ease of operation:

(1) As the vehicle crosses into the sunlight on its recovery orbit, the solar sensor is used to align the longitudinal axis directly at the sun; at the same time a set of three caged orthogonal body-mounted gyros are set into motion to warm up.

(2) Once the sunline is precisely established, the body-mounted gyros are uncaged by the cosmonaut, thereby establishing a highly accurate inertial attitude reference for deorbit.

(3) With the inertial reference established, the vehicle is then oriented to fire the retrorocket at the programmed time and in plane angle to achieve impact in the designated area.

~~(S)~~

d. The retrorocket unit is identical on all Vostoks and Vostok-type vehicles (Sputnik 4 and Cosmos 12 are specific examples); it has a nominal 40.3-second burning time and is a single chamber, liquid bipropellant turbopump rocket. The estimated thrust is 3,580 ± 380 pounds with a velocity decrement (ΔV) of 464 ± 49 ft/sec. The retrorocket has a constant ΔV; therefore, it is necessary for the Soviets to adjust the retropitch

angle for each of their satellites in order to achieve impact at specific locations. This will result in both positive and negative retropitch angles being possible for the Vostok series. ~~(S)~~

e. About 8 to 9 seconds after termination of retrothrust, the life support cabin is separated from the instrument and retro-package. Both units re-enter the atmosphere at an angle between 1.7° and 2.5°. ~~(S)~~

f. The life support cabin must be reoriented to place the heat shield along the path of the velocity vector; there is no specific telemetry to verify the exact nature of this event. ~~(S)~~

Background Highlights

Information utilized for this paper consisted of Lockheed ESS reports, Goodyear Astroanalysis reports, Foreign Technology Division studies, and other intelligence contractor studies. All basic material used was at the Secret or lower level; however, there is other background data available to substantiate portions of the report.

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Discussion

See Section I for an introduction and remarks on some basic assumptions made for purposes of this report. (U)

SECTION I

(U) INTRODUCTION

1. There are several basic assumptions which have been used throughout this report. There are valid reasons for most of the assumptions; however, in some instances, only a "best guess" is possible. The following items form the basis for most of the statements reflected in later sections:

a. The Vostok is a simple ballistic vehicle which produces no lift and follows a purely ballistic re-entry trajectory.

b. The deboost retrofirings for the Vostoks all occur at approximately the final equatorial crossings of each vehicle.

c. The ballistic coefficient ($\frac{W}{C_D A}$) for the re-entry vehicle is about 100 lbs/sq ft.

d. The re-entry angles of the Vostoks were within a -1.7 to -2.5 degree range.

e. Small changes in orbital and deboost parameters have a marked influence on impact dispersion. For a re-entry angle on the order of -2°, an error in retro alignment will yield a 25-nm per degree error; similarly, the impact point error due to retro-velocity impulse error is on the order of 2.5 nm per ft/sec, whereas landing errors due to altitude errors are about 25 miles per mile.

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2. In many instances, the available information allows a choice of several alternatives as to the actual meaning of an observed event. In those cases, each of the possibilities is listed and discussed. (U)

SECTION II

(U) EVENT SEQUENCE

1. A review of available telemetry analysis along with collateral and background information for the Vostok flights has resulted in the postulation of an event sequence as follows (also see Figure 1):

a. Re-Entry Decision: Made by the Moscow Mission Analysis and Control Center utilizing data from the Moscow Computing Center and real-time information from the cosmonaut in orbit. (See Section III.) ~~(S)~~

b. Spacecraft Orientation for Retrothrust: The spacecraft is oriented for retrofire through the use of IR horizon scanners, rate gyros, and a solar sensor. The exact mechanization and use of these devices is the subject of considerable debate. See Section IV for a discussion of the most probable schemes and possibilities. See Figures 2 and 3 for deorbit schematics and parameters of interest. ~~(S)~~

c. Deorbit Command and Retrothrust: The exact time to initiate the retrorocket is believed to be set into the Vostok's electronic programming device before launch; it is then updated with real-time tracking information as the vehicle passes over

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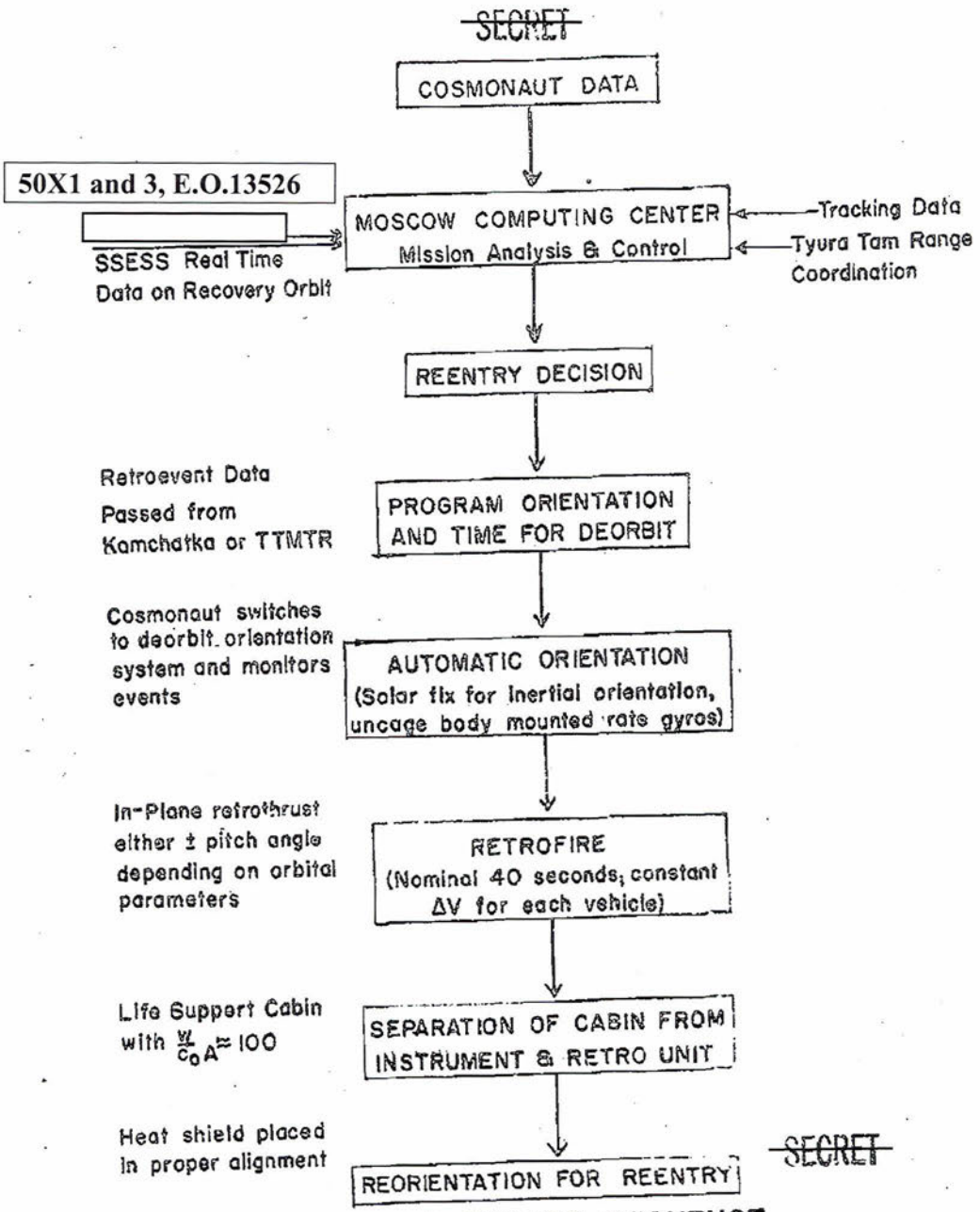

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FIG. 1 (U)VOSTOK EVENTS SEQUENCE

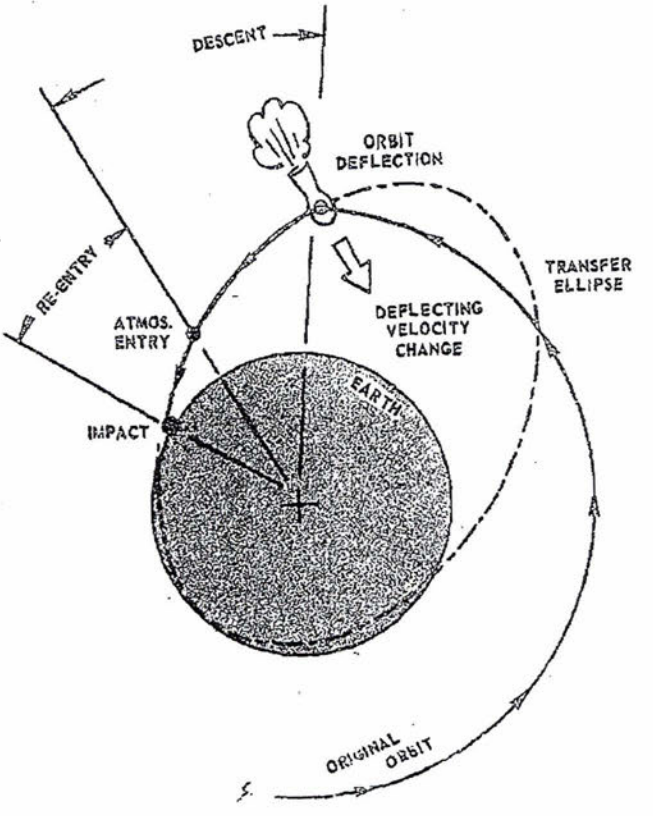

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FIG. 2 ONE-IMPULSE DESCENT FROM ORBIT

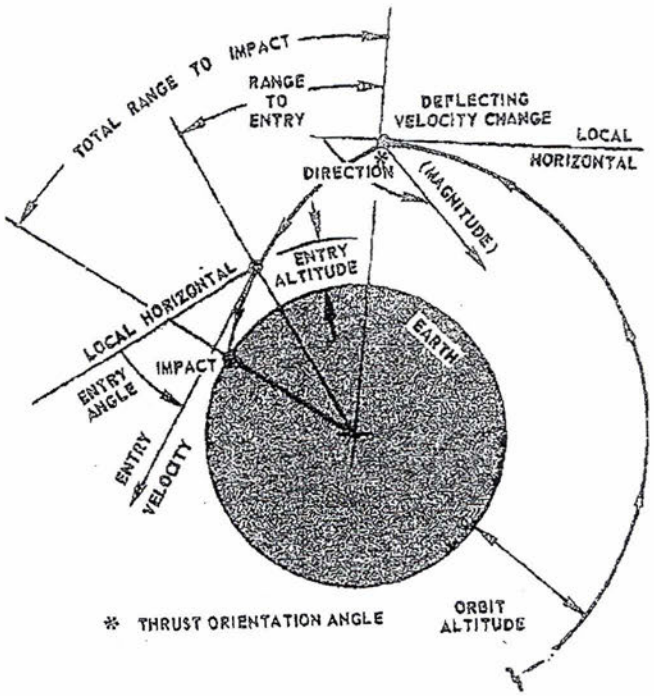

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FIG. 3 PARAMETERS OF INTEREST

the rangehead or Kamchatka on its last (recovery) orbit. Additionally the SSESS could conceivably play in a role in the deorbit sequence. (See Section V.) (S)

d. Reorientation for Re-Entry and Post Retrophase: There is a separation of the life support cabin from the instrument retropackage. It is then necessary to reorient the life support cabin to align the heat shield along the path of the velocity vector. This may be a matter of only a few degrees, depending on the attitude of the spacecraft at retrofiring; however, it is difficult to verify this event for the Vostoks.

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(See Section VI.) (S)

2. In addition to the automatic deorbit system described above, the Vostoks also have a manual deorbit orientation system in anticipation of emergency situations. This system would have an override capability over the automatic system and would be capable of executing the same sequence of events as the other system with the exception of the solar fix. In the manual mode of operation, information would be transmitted to the cosmonaut to update his instruments, and also to provide him with instructions and precise times for retro events. (See Section VII.) (S)

SECTION III

(U) RE-ENTRY DECISION

1. The total flight time of each Vostok vehicle is constrained by the amount of life support aboard and by the extent to which the desired mission parameters are achieved. There are provisions for emergency recovery in the event of a subsystems failure, or if the orbital characteristics are in error. The decision to "go" or "no go" is the responsibility of the Mission Analysis and Control Group in Moscow; this group has the data from the Moscow Computing Center and coordinates with the rangehead on many matters concerning the re-entry recovery phase. (S)

2. Vehicle telemetry and space tracking information is transmitted to the Moscow Center on a real-time basis. Orbit parameters are continually updated and analyses conducted to insure a stable orbit, proper orientation, cosmonaut well-being, and accomplishment of desired mission aims. (S)

3. The cosmonaut would also provide the Mission Control Group his personal feelings regarding any plans for continuing or terminating a flight. (U)

4. Once the decision to re-enter has been made, the Control Group will notify the vehicle and alert the cosmonaut to initiate

the deorbit sequence at the proper time. If in the automatic mode, the cosmonaut will monitor the deorbit instrumentation, while in the manual mode, he will naturally be in personal control of each event in the sequence. (U)

SECTION IV

(U) SPACECRAFT ORIENTATION FOR RETROTHRUST

1. This phase of the deorbit sequence is the most critical portion of the entire mission; and at the same time, it is the phase about which many different viewpoints exist.

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b. Sun Orientation for Retrothrust

The thesis that the longitudinal axis of the craft (and thus the retro unit) is pointed at the sun during the entire time from initial orientation to post-retrofiring has been explored in great depth by other analysts. Essentially, they feel that the concept of using the sun to orientate Vostok space vehicles prior to retrofire can be given some credulity by the following factors:

(1) Soviet open releases announced the aligning of an axis toward the sun prior to retrofire for the Vostoks. Since all Vostok flights have been similar, there is an indication that sun orientation was used for all Vostok flights. After the successful flight of Vostok I, the Soviets described in their literature for the first time the use of the sun in determining a reference axis for the Vostok automatically controlled attitude orientation prior to retrorocket ignition. In a Soviet publication, "The First Manned Space Flights," the following statement appeared: "The ship lands in a specified area after turning on the braking engine

installation, an operation which changes the orbit of the spaceship. When turning on the braking engine installation, the axis of the spaceship along which the engine is installed must occupy a definite angular position in space. This problem is solved by a system of automatic or manual orientation. The system of automatic orientation searches the sun, 'locks on to it,' turns the ship, and puts the appropriate axis in the direction of the sun. . . . The setting and maintaining of the appropriate axis in a definite position occurs with the necessary precision."

Although the wording above does not actually state that the spaceship axis along which the engine is installed is directed toward the sun, it appears that a solar orientation of retrorocket theory could be supported by the wording of the text. (S)

(2) All Vostoks were launched during the summer months which allow for a south- to north-landing pattern. Generally speaking, the retro point in the summer is closer to the Soviets' selected landing point than if retro occurred in the winter. Of course, major factors affecting range such as altitude and flight path angle at retro must be taken into account when making comparisons of any particular flights. The portion of the orbit during which solar orientation may be utilized for

re-entry during the summer months is restricted to the approximate quadrant beginning with emergence from the earth shadow and ending at a position some 30° or so north latitude. The dates between October and February appear more unattractive for use of this technique than the remainder of the year since the generally larger azimuth angles to the sun would allow only small in-plane components of retrothrust. However, a suitable elevation angle to the sun can be obtained on any date by selecting the time and/or the latitude of retro. (S)

(3) It is alleged in Reference 1 that all Vostoks deviated to the left of their projected orbital plane during re-entry with the exception of Vostok V which went to the right; however, it is most difficult to verify this supposition with hard data.

If both in-orbit and normal-to-orbit vectors of a sun-orientated system are used, the inclination of the deorbit trajectory may be slightly changed, either to the east or west from the original orbital calculations. Due to the lateral component of retrovelocity which occurs when a sun-oriented retrorocket system is used, the inclination of the orbital plane is changed after retrofire. (S)

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(S)

(5) The sun orientation scheme would bear out the Soviets' reputation for simplicity and reliability in their instrumentation techniques. (C)

c. Solar Fix Orientation System

This is a Vostok deorbit orientation system postulated by the Foreign Technology analysts of the Deputy for Foreign Technology at AFMDC. It is based on open source literature, telemetry data, and other background information, and is completely described in Technical Report AFMDC-TR-63-8 entitled Vostok Control Equipment prepared by Captain James E. Howard. Basically, the system is as accurate as subparagraphs a and b above, and is a realistic approach to the deorbit orientation scheme and its associated control problems. The following events would occur in the deorbit sequence:

(1) As the vehicle enters the sun on the recovery orbit, the so-called "solar orientation system" is activated and the cosmonaut would then verify this event through his instrument panel. The longitudinal axis of the spacecraft is aligned to point directly at the sun through the use of the sun sensor; at the same time a set of three caged orthogonal body-mounted gyros is also set into motion to warm up. (8)

(2) Once this sun pointing attitude is precisely established (and good solar devices are accurate within two seconds of arc as a practical limit), the body-mounted rate gyros are uncaged in a separate event, and the inertial attitude

reference is thereby established. Yaw and pitch, the two most critical attitudes, can be determined directly from the sunline without complex computation. Roll would be established with the horizon sensor and transferred to the appropriate gyro. This will insure that no loss of roll reference will occur at excessive pitch angles, and further negate the need for an extra roll horizon seeker as could be required in subparagraph b above. The subsequent maneuvers to the desired deorbit attitude are made through precalculated and programmed torquing commands to these body-mounted gyros. Once the gyro reference is established, the solar sensor is no longer required, and can be electronically removed from the control system. This establishment of a solar fix then effectively reduces any gyro drift errors in the deorbit system to a negligible quantity inasmuch as the retrorockets will normally fire about 10 minutes later. (S)

(3) The retrorockets then fire at the programmed time and at the programmed angle (in the orbital plane) to achieve impact in the designated recovery area. Proper orientation during the nominal 40-second retrothrust period would also be precisely determined by the three body-mounted gyros. (S)

5. In reviewing the suggestions in paragraph 4 above, it is readily apparent that a variety of mechanizations can be postulated from the available data; however, it is felt that the sun orientation for retrothrust would create tremendous control problems and degrade the accuracy of the sensor itself. Additionally, it does not appear compatible with the manual earth reference system used to back up the automatic system. It should also be noted that the large yaw and pitch maneuvers observed 9 seconds after retroburning (Vostok II) are very possibly movements of the separated instrument package, and not orientations of the life support capsule. The other possibilities are certainly straightforward, workable, and within demonstrated Soviet capabilities. It remains purely a personal choice as to which mechanization would provide the more logical and accurate deorbit orientation. /S/

SECTION V

(U) DEORBIT COMMAND AND RETROTHRUST

Deorbit Command Link

1. Open Soviet literature reflects statements to the effect that:

a. An electronic programming instrument in Soviet space vehicles issues the command to fire the retrorocket; most simply, this would be a precision clock or timer.

b. The exact times are set into the programmer by commands which are computed at the Moscow Coordinating Computer Center. (U)

2. As a practical matter, the times stored in the electronic programmer at launch would have to be continually updated by information from real-time tracking data. Ground commands would be relayed to the Vostoks from any number of sites -- most probably, however, the commands originate from Kamchatka and/or the Tyura Tam rangehead on favorable orbits. There is also good basis for suspecting that the deorbit phase is supported in some specifically undefined manner by the SSESS. These vessels (Dolinsk, Aksai, Krasnodar, and Il'ichevsk) have been located off the African coast for each

Vostok flight such that they are ideally positioned for data collection on recovery orbits. They could be utilized in the deorbit command link; however, firm substantiation is lacking. In the event of an unprogrammed earlier deorbit by the cosmonaut, the ships would also serve as an emergency recovery center. (S)

3. A radar link for the deorbit command is certainly plausible and highly possible; however, no specific information exists to verify its use. Such a link is very secure from detection because of the high directivity of the antenna and wavelength, and is relatively easy to use. (S)

Retrothrust

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With this constraint, the only flexibility in the system (to achieve a given range from the deboost point) is to vary the retrothrust pitch angle. Because of the relatively small retrovelocity decrement (on the order of 464 ft/sec)

when compared to orbital velocity (~25,500 ft/sec), it would be necessary to adjust the pitch angle for each satellite in order to achieve impact at a specified point. This differing of pitch angles is primarily required because:

a. Each satellite is traveling at a different velocity which may be a considerable factor when compared to the relatively small retro decrement.

b. Each satellite's orbit is different -- perhaps only slightly when viewed numerically; however, it is quite significant in terms of retrorocket performance and altitude at retrofire -- an extremely sensitive parameter. In this scheme, both positive and negative pitch angles could occur at retrothrust depending on the other variables of the individual Vostok orbits. This allows the Soviets to effectively:

(1) Choose the deboost point to occur when they believe it to be free from western observation, or more likely where their SSESS might monitor the event.

(2) With an apparent excess of total retrothrust available at one deboost point, the Soviets in a malfunction firing case have a chance to reprogram the retrofire event to a few minutes later in the same orbit, and still impact in a pre-selected recovery area -- merely by altering the retropitch angle.

(3) In those instances where a positive retro angle is used, a lofting velocity decrement (up and to the rear) results, this has the added advantage of having the vehicle roughly aligned for the re-entry portion of the flight. Computer runs have been made by various agencies using the retrorocket parameters, deboost locations, orbital ephemeris, and probable impact locations. The results indicated that each Vostok and Vostok-type vehicle used a different retrothrust pitch angle depending on the input variables. The pitch angles thus derived included both positive and negative quantities. ~~(S)~~

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SECTION VI

(U) REORIENTATION FOR RE-ENTRY

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3. There is no evidence available to determine the actual movements associated with the vehicle after retrothrust. The blunted heat shield of the cabin must of course be aligned to place it along the path of the velocity vector. If the vehicles orient a

lofted-type retrofiring as discussed in Section IV, there would be only a slight realignment in pitch required. (S)

4. After re-entry the vehicle slows down enough to deploy its drogue chute between 20,000 to 30,000 feet; at 10,000 feet a final chute is deployed (about 1,000 pounds to yield a ground impact velocity of 25 ft/sec) of the shaped, solid textile, circular type. Location aids such as beacons and flares are probably used to aid recovery forces. (S)

SECTION VII

(U) MANUAL ORIENTATION SYSTEM

1. When in the manual override phase, the cosmonaut himself can actuate the gas jet controls to maneuver the vehicle about all three axes. He also has the capability to initiate deorbit action -- i.e., orientation and retro ignition. For manual orientation the Vostok is equipped with (as Titov describes it) "that magnificent colored globe of the world which would rotate in unison with the oceans and continents soon to rotate under my spaceship and tell me precisely where I was at any given moment." This globe has a line marked on it which allows it to be used somewhat like a drift meter for alignment of the longitudinal axis of the Vostok. When the pitch and roll alignments are correct, the horizon around the earth may be seen around the perimeter of the globe. The position accuracy for retrofiring can probably be determined to about ± 50 miles. This indicates the rotation of the globe is accurate to ± 1 or 2 minutes of arc. In view of the relative simplicity of such manual orientation devices, it is certain that they are useful only for near earth satellite vehicles with small orbital eccentricities. Also, according to Titov, after manually firing retros, another

switch could be thrown which would automatically rotate the globe rapidly and show the cosmonaut the landing point to be expected. It is expected that the globe would be updated from time to time by accurate tracking information from the ground. (C)

2. In addition to the globe device, there is an optical orientation instrument consisting of two annular reflecting mirrors, a light filter, and a viewing glass marked with a grid of lines similar to drift meter lines. This device will yield flight direction and the local vertical. The ship is properly oriented to the vertical when the image of the horizon in the field of vision is viewed as a ring. It is estimated that the cosmonaut could orient the spacecraft about its three axes to an accuracy of ± 30 minutes of arc. (C)

3. In addition, the cosmonaut probably had access to the error sensors of the automatic orientation system. (C)

4. If an emergency arose, there would have to be a standard manual orientation maneuver for the cosmonaut to perform. This maneuver would be expected to yield about the same re-entry angle and total range to impact as the automatic system. The optical orienting device could be scribed to reflect the designated orientation -- most likely, roll and yaw, zero degrees, and a standard pitch angle to achieve programmed re entry (C)

5. There is no efficient manner in which the cosmonaut may manually obtain a solar fix for his deorbit orientation system; therefore, it is not likely that the sun sensor would be utilized in the manual mode of operation. (C)

6. There would probably be a separate pressurized gas supply for the manual orientation system to provide needed redundancy for an emergency situation. (C)

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UNITED STATES AIR FORCE
Holloman Air Force Base, New Mexico 88330

REPLY TO ATTN OF: MDF

15 Jan 1964

SUBJECT: (U) MDF Monthly Progress Report - December 1963, RCS: AFSC-R38

TO: AFSC (SCFDD)

1. GENERAL AND ADMINISTRATIVE

a. Personnel:

	Authorized	Assigned
MDF	1	1
MDFA	2	1
MDFB	7	7
MDFC	5	3
TOTALS	15	12

(U)

b. Temporary Duty Travel:

Mr. Michael E. Cason, Jr. (MDFB) spent 9-12 December at FTD. TDSPAO Support and Offensive TOPS meetings were attended on 9-10 December; 11-12 December was spent working on various analytical problems of mutual concern to AFMDC and FTD. (U)

c. Visitors:

(1) On 6 December 1963, Col George W. Scott, Lt Col John R. Patterson, Dr. S. Skolnik, and Mr. David A. Pierson, all of SSD, visited MDF to discuss some recently derived information on Soviet missile and space tracking capability. During the visit, MDFB presented a short briefing on the past, present, and future operations of the Technical Evaluation and Applications Directorate. A visit was made to ASD's Cloudcroft Electro-Optical Site where MSgt Villott conducted a tour of the facility. (S)

(2) Lt Col Frank W. Angevine from Hq AFSC (SCFDD) visited MDF facilities on 12-13 December 1963. (U)

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d. General:

(1) Effective 23 December 1963, Mrs. Jessie G. Babcock was placed on loan from MDF to MDFC to permit continued operation of the Technical Support Directorate. (U)

(2) Mr. Michael E. Cason, Jr. (MDFB) has tendered his resignation, effective 7 February 1964, to accept a position with the Lovelace Foundation in Albuquerque, New Mexico. (U)

2. TECHNICAL EVALUATION AND APPLICATIONS DIRECTORATE (MDFB)

Space Analysis Program.

(1) Document AFMDC-VW-63-2 authored by Mr. Michael E. Cason, Jr., and entitled "Vostok Recovery Forces" was forwarded through AFSSO channels to FTD. The document fulfills the requirements of Task 618204(4.5.1). Some 220 manhours were used in preparation of the document. (S)

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(2) AFMDC Technical Report 63-8, "Vostok Spacecraft Guidance and Navigation Equipment," by Capt James E. Howard and meeting the requirements of Task 618204(3.3.9.1) was sent to FTD and ESD during the month of December. The report discusses automatic control systems, manual control systems, control force generation, and deorbit and re-entry control. Nearly all the material available for the analysis was from open source literature, [redacted] It was, however, possible to specify the most probable system for orientation and the types of torquing devices used, both hot and cold gases. Among other conclusions the report defines a deorbit orientation scheme that accounts for the use of the sun prior to deorbit and, as well, accommodates the requirement for more sophisticated guidance than sunpointing up to the time of retrofire. A total of 236 manhours was required for this task. (S)

(3) AFMDC Technical Report 63-9, "Vostok Retrofire and Deorbit Systems," authored by Capt William J. Barlow was submitted in fulfillment of Task 618204(3.3.8.3). The following interesting conclusions are drawn:

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(a) The deorbit decision is made by the Moscow Mission Control Group based on mission accomplishment, cosmonaut inputs, and orbital parameters;

(b) Ground commands are passed to Vostoks possibly through a highly directional radar link from Kamchatka, Tyura Tam, or perhaps the SSESS,

(c) There is a separate automatic deorbit orientation system comprised of a solar sensor, rate gyros, and horizon scanners;

(d) The retrorocket unit is the same for all Vostoks and Vostok-types;

(e) 8 to 9 seconds after retro burnout the cabin is separated from the retro-instrument package, and

(f) The cabin must then be reoriented to place the heat shield foremost.

This task required some 249 manhours for accomplishment. (S)

(4) The MDF Technical Brief 63-17 was written by Mr. Julian S. Nichols to fulfill the requirements of Task 618204(2.2.6.1). Entitled "(S) Vostok Launch Vehicle Guidance and Control," the Brief points out that the launch vehicle uses the booster and sustainer of the SS-6 plus the Lunik-type third stage. No radical changes in the radio inertial guidance of the SS-6 system are postulated. The third stage guidance is estimated to be inertial in the pitch plane and inertial in the yaw plane with a ground radio command override. Manhours required for this task were 44. (S)

(5) Total manhours expended through December on completed SPAO tasks equal 3,233. (U)

3. TECHNICAL SUPPORT DIRECTORATE (MDFC)

a. General:

With the loss of the MDFC secretary on 9 December 1963, the efforts of the Technical Support Directorate were primarily concentrated on supporting the analytical projects of the Technical Evaluation and Applications Directorate during the reporting period. (U)

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[redacted]

b. Status of Data Central System:

Acquisitions during the month of December:

(1) Project White Stork: 1,200 PWS cards were acquired during the month.

(2) Project Gold Eagle: 100 PGE cards were received during the reporting period.

(3) CIA Personality Cards: 150 cards were received. (U)

c. Inventory of Vault and Collateral Data:

(1) Vault Material:

Bound publications - 1,625
Letters and messages - 291
Tapes - None
Photographs - 50
Movies - None
Total linear feet utilized for storage - 44

(2) Collateral Material:

Bound publications - 2,161
Letters and messages - 585
Tapes - 3 reels
Photographs - 24
Movies - 2 reels
Other - 22,100 cards; 532 IR's and case files
Total linear feet utilized for storage - 84 (U)

d. Foreign Activities Monthly Report (U-60 Format):

Negative report. (U)

FOR THE COMMANDER

Howard L. Conkey

HOWARD L. CONKEY
Lt Col, USAF
Deputy for Foreign Technology

1 Atch
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