

HIGH FRONTIER

An SDI Wargame

INSTRUCTIONS FOR
ZX SPECTRUM
48K/128K/+



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1. INTRODUCTION

This program is about the construction and use of the proposed American Strategic Defence Initiative (SDI) - the "Star Wars" system. SDI is intended to prevent missile-borne nuclear warheads reaching the American mainland.

The player is in charge of the development and eventual use of the SDI system. The task is to build up an effective SDI system that will defeat Soviet nuclear attack. The program uses icons for ease of play and has game load and save options. The player can vary a number of factors before the start of the game.

2. LOADING

SINCLAIR ZX SPECTRUM USERS

- * Set your computer system as detail in the manufacturers user guides that accompany your computer
- * Switch the computer and monitor on
- * Load the cassette into the cassette holder and rewind to the beginning of side one.

- * If you have a Spectrum 48K computer type Load ""then enter then press play on your cassette recorder. If you have a Spectrum 128K computer select the Tape loader option press enter then press play on your cassette recorder.

3. GAME SELECTION

After loading, the Game Selection screen appears. This enables the player to alter various factors in the simulation before starting play. You can play the main game or go directly to the Orbit section of the game. Note that the simulation is set on loading for the "beginner's" level. It is recommended that you first try running a few simulations without altering these settings to get practice.

1) Set American Leader Type

The box in this area with the tick in is the currently selected type of President. If the joystick is moved sideways, the yellow command cursor will move from box to box. Pressing the fire button when the cursor is by the desired box will cause a tick to appear. That President type is now selected.

2) Set Soviet Leader Type

Moving the joystick down will put the command cursor into this area. The type is set as above, but note that you cannot have both a "Dove" President and a "Dove" Soviet leader (hopefully this is not true of the real world).

3) Set Game Level

This has various effects on the game and at first you should leave it set on the "EASY" level. When you have mastered the mechanics of the game you can progress to the harder levels.

4) Action

The various possible actions are chosen in the same way as above, by positioning the command cursor and pressing the fire button. Actions are as follows:

PLAY: This will start the game.

LOAD/SAVE

instructions (Section 14).

ORBIT: Selecting this will take you directly to the orbit section of the game.

You can then practice fighting in orbit. See the Orbit Section (Section 15).

4. BORDER DISPLAY

NOTE. The word SELECT has a special meaning in this manual. It means position the current command cursor below the icon in question and press the joystick fire button. Also note that the numbers in square brackets, for example [C1], refer to the numbers printed on the screen diagrams in this manual.

HIGH FRONTIER is a multi-screen game. All screens (except the orbit screen) have a common BORDER DISPLAY of icons and information panels, at the sides and bottom of the screen. The contents of the central screen window depends on which screen is selected.

The lower command area is composed of boxes containing icons – these are the COMMAND icons [C1-C6]. Below these is a yellow cursor – the COMMAND CURSOR. The command cursor can be moved left or right with the joystick.

- [C1] TELEPHONE – The president's direct line to you.
- [C2] WORLD – Shows the world and the BCÓM pad and allows time to pass.
- [C3] SHIELD – SDI Command screen
- [C4] CALCULATOR – Research & Development (R & D) screen.
- [C5] CAMERA – Espionage & Reconnaissance screen.
- [C6] SKULL – Threat screen.

If a command icon has a yellow bar across the top, it means that the department wants your attention.

The box at the bottom right [C7] is the Calendar display. This shows the current month and year of the simulation. The bottom red line of this display is used only in the event of a Soviet missile attack; when this happens, the red line will display the Battle Computer's predicted time to impact in minutes and seconds (that is, the time remaining before the first nuclear warheads hits America).

The right side area is the ORBIT DISPLAY [B1-B6]. When any system satellites are placed in orbit, the relevant Orbit Display Box will turn green. The number of system satellites currently in orbit will also be shown. If the display box turns yellow it means that the system satellites are armed on firing.

The left side area is the ATTACK DISPLAY: it will become active in the event of a Soviet nuclear attack. The box colours will change and the numbers of warheads, missiles, and so on, will be displayed. Each box has a different purpose.

- [A1] – The number of Soviet ICBMs heading for America.
- [A2] – The number of ICBMs that your system have destroyed so far.
- [A3] – The number of Soviet nuclear warheads approaching.
- [A4] – The number of warheads that your systems have destroyed.
- [A5] – The number of nuclear impacts (explosions) on the American mainland.
- [A6] – The number of impacts on urban areas.

Note that this display has a slightly different purpose when the INQUEST screen is displayed.

5. PRESIDENT'S MESSAGES

To display this screen select the PHONE icon.

The President will ask questions or supply codes and orders via this screen. The "Number of Warheads" question is answered as follows: position the yellow indicator on the percentage scale by moving the joystick left or right. Pressing the fire button will send this value as your answer.

As world tension increases, the President will issue you with the ARM/DISARM codes (push the joystick forward to open the code box), and may eventually order you to arm the system. You do this after selecting the SDI COMMAND screen. If the systems are armed they will automatically attack any Soviet ICBM missiles that are launched.

NOTE: The President will only issue the ARM/DISARM codes once in any game. It follows that it does not pay to ignore the President! Once the President has issued the Arm/Disarm codes AND you have received them, they will be permanently displayed below the President's message pad.

HIGH FRONTIER COM 64 WORLD SCREEN

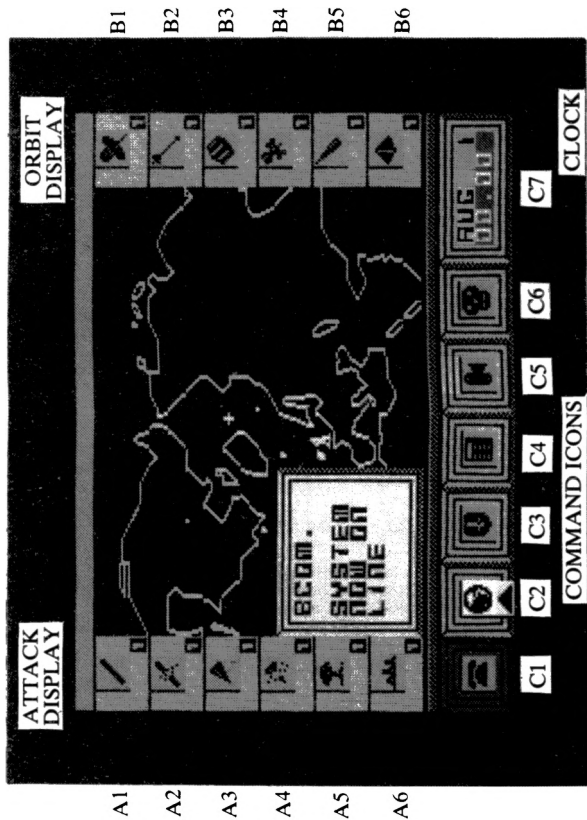


FIG. S1

6. WORLD SCREEN

To enter this screen, select the **WORLD** icon. The screen displays a view of the Earth taken from a satellite above the North Pole (see Fig. S1). The grey rectangle marked **BCOM** is the Battle Computer's message pad.

The game starts with the **WORLD** screen in view (but time frozen). The date is March, Year 1 of the project as shown by the Calendar Display, bottom right. If the World screen is entered, time will pass and the calendar will change. After dealing with the interruption (or not - your choice), you restart the calendar by selecting the **WORLD** icon again.

If you wish to break out of the **WORLD** screen when the calendar is running, move the joystick left or right.

7. SDI COMMAND

To enter this screen select the **SHIELD** icon.

The **SDI Command** (see Fig. S2) is used to control any systems that you have built using the **R & D** screen. Note: until a system has been built, the **SDI Command** has no purpose, and you cannot give any commands.

The top display box [D9] shows a picture of the currently selected system. Below the picture is shown the number of system satellites that are currently on the ground.

The left and right boxes [D6, D8] of the second row are the predicted kills for each satellite of the system. The left box shows the missile kills per satellite, the right box the warhead kills (predictions are not always reliable!).

The centre box [D7] shows the current status of the system. The symbols are the same as the **R & D** project status symbols, with the following additions:

CIRCLE WITH DOT - Some or all of the system satellites are in orbit.

LIGHTNING FLASH - System armed or firing.

The third row of boxes represents the **SDI Command Line** and enables players to issue command to the systems:

[D1] DOWN ARROW

Is used to exit the **SDI Command** screen.

[D2] ROCKET

When you have successfully developed an **SDI** system, you will start to build satellites for that system. Obviously, these will not be in orbit until you have launched them. To place satellites in orbit you must first select the correct **SYSTEM DISPLAY** on this screen (see [D5]), then select this icon to set a **LAUNCH COMMAND**. The system satellites will now be launched into orbit, over a period of time, causing the number of system satellites in orbit to be shown in the **Orbit Display**. When a system has been ordered to launch, the Launch icon will be white. To cancel a launch command, simply select the Launch icon again.

[D3] LIGHTNING FLASH

If a system has been built **AND** is in orbit, it can be armed or disarmed, provided the player has the correct codes. Selecting the lightning flash icon will cause the Code Enter Device to appear [D10]. Moving the joystick forwards or backwards will alter the code letters and numbers. When you have set the correct code, move to the **X** at the right of the Code Enter Device; pressing the fire button will enter the code you have selected and return you to the Command Line. If the system **ARM** icon is white,

HIGH FRONTIER SDI COMMAND SCREEN

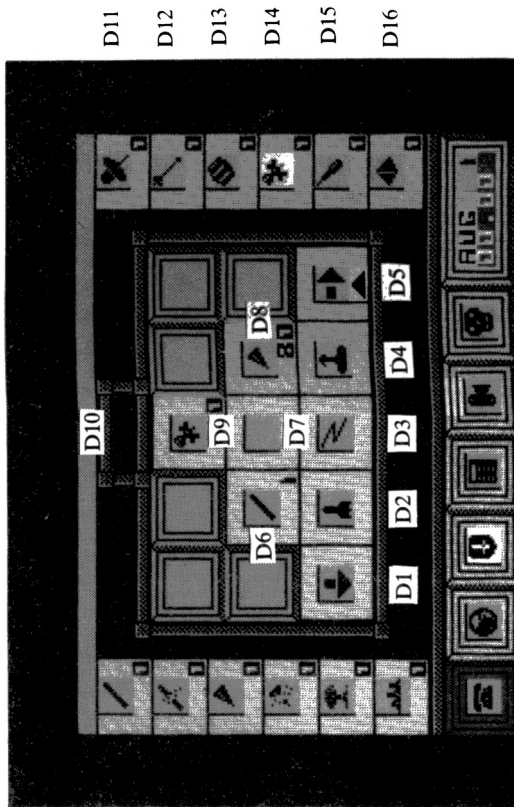


FIG. S2

the system is armed. To disarm the system, simply repeat the above but enter the disarm code.

[D4] JOYSTICK

Allows the player to take manual control of a system satellite in orbit (see the ORBIT section of the manual).

[D5] RIGHT ARROW

Used to scan all the systems. Put the command cursor under this icon and press the fire button. The screen will change and display the next system. The current system is shown in the top box [D9]. Note also that the system's picture in the Orbit Display will be highlighted in white.

8. RESEARCH & DEVELOPMENT

To display the R & D screen select the CALCULATOR icon.

The object of the game is to build a defence of SDI systems which will destroy a Soviet missile attack. The R & D screen (see Fig. S3) is used to build and maintain these systems.

The R & D department will want your attention when it receives more money from the Federal budget. You can then decide which SDI systems you wish to try and develop, and assign money and personnel to the projects you are pursuing.

Each system has a project compartment [R1-R6], at the bottom of which is a picture of the system. Above this picture is the System Project Status Area, which is blank if no work has been carried out on the project. (Thus at the start of the game, all these will be blank). The rest of the system compartment is used to hold the money and number of staff assigned to the project. You will notice white horizontal lines in the slots: these show the level of funding and staffing required to complete the next phase of the project.

At the top of the screen is a cursor, which can be moved left and right with the joystick. When the cursor is moved over a \$ symbol [R9], pressing the fire button will assign money to the project. If the cursor is over a people symbol [R8], you can assign staff in a similar way.

When a project phase is complete, the money will be spent and the new phase costs shown with the white lines. If the system's project status has changed, this will be shown in the status area. If you have developed a system, the number you are building will be shown below the system picture. The project status symbols are as follows:

- X - Some work has been carried out but no solution as yet.
- TICK - The problems are nearly solved
- ROCKET - The problems are solved. The number you are building (this year) is shown below the system picture.

If the Rocket symbol is shown without a build number, the project is complete. The white lines will now indicate the costs of maintaining the system. People shown in white are government employees: people in colour are not, and you have no direct control over their movements.

To exit the screen, place the White House over the blue down arrow [R7].

HIGH FRONTIER RESEARCH & DEVELOPMENT SCREEN

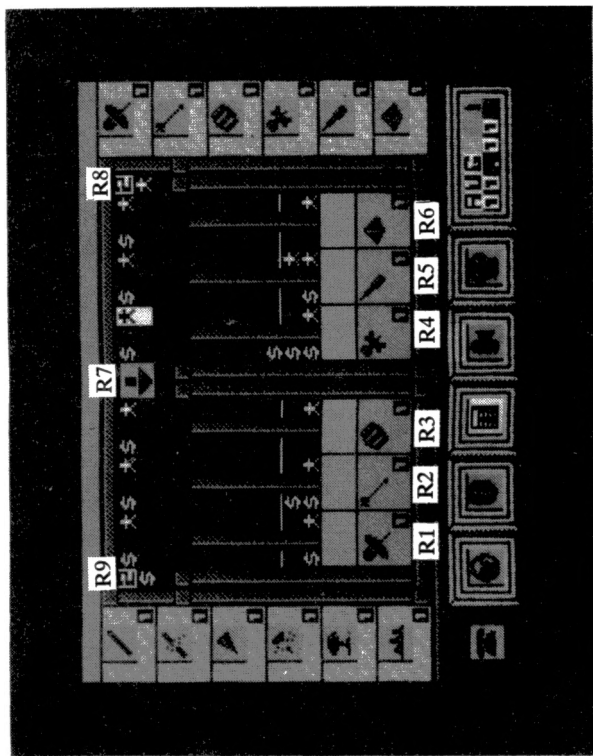


FIG. S3

NOTE: For details of the various systems, see Section 24, SDI SYSTEMS (IN THE GAME).

9. ESPIONAGE & RECONNAISSANCE

To display this screen select the CAMERA icon.

The player should use this screen (Fig. S4) to try to find out what the Soviets are doing to defeat thier systems. You can achieve this by assigning "espionage" points to various intelligence efforts. When any information has been gathered or further points become available, the department signals you as usual.

The espionage points available are shown in the top box [E5]. The points are assigned by moving the cursor over the desired camera and pressing the fire button. The camera boxes [E2-E4] represent the areas where you may place your intelligence effort. These areas are as follows:

[E2] LEFT CAMERA

Attempts to discover the number of ICBMs (missiles) currently targetted against you. The results of this effort are shown in displays linked to the camera by white lines. The number of land-based ICBMs is shown in [E6]. The number of submarine-based ICBMs is shown in [E7].

[E3] MIDDLE CAMERA

Tries to learn the number of warheads targetted against you. This is shown in [E8].

[E4] RIGHT CAMERA

Monitors any Soviet counter-measures against your systems. These are shown in the displays [E9-E14]. For example, if the Soviets had developed the ability to destroy ten laser system satellites, the number 10 would appear in the [E9] display.

[E1] BLUE DOWN ARROW

Exits the screen.

WARNING: Remember the Soviets will be using counter-espionage against you. This means that the figures you see are not necessarily true. For example, you may be shown that the Soviets are developing counter-measures against your systems, when in reality they have not. Obviously the more "points" you assign to an effort, the more likely it is that you have a true figure.

10. THREAT SCREEN

To display this screen select the SKULL icon.

The current world position, any changes in the Soviet Military forces, and the threat level are shown on this screen (see Fig. S5). The THREAT LEVEL INDICATOR [T1] has a yellow pointer: the closer this moves to the mushroom cloud, the more likely the possibility of war; the nearer to the heart symbol, the more peaceful.

The symbols and numbers at the lower right are the status of the various Soviet units, as follows:

[T2] - ICBM silo status.

[T3] - Status of ICBM-carrying submarines ("Boomers").

HIGH FRONTIER ESPIONAGE/RECONNAISSANCE

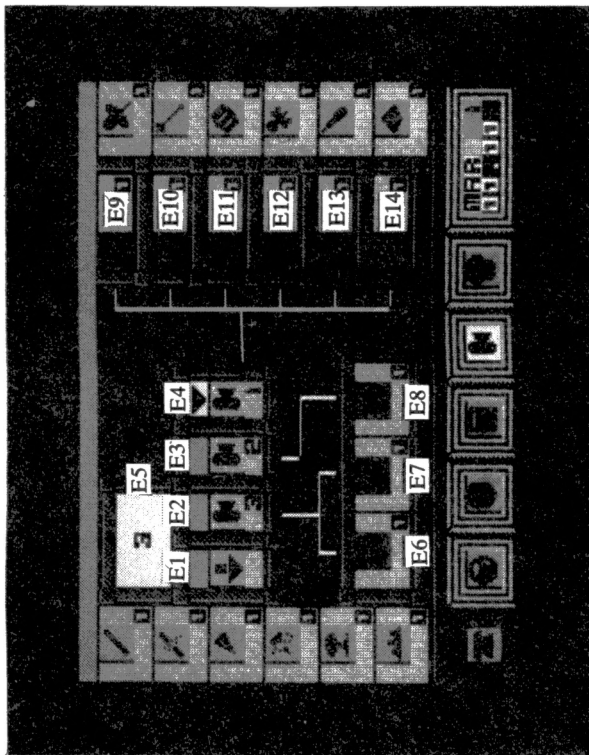


FIG. S4

HIGH FRONTIER THREAT SCREEN

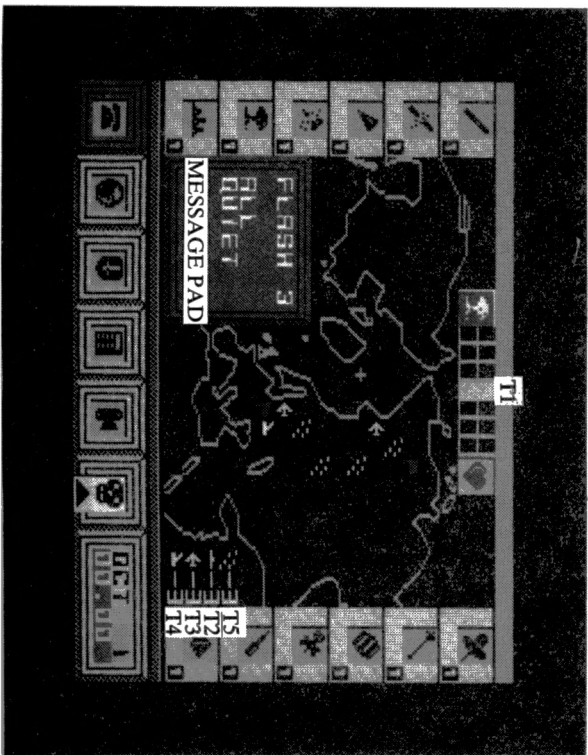


FIG. S5

- [T4] - Air Force status.
- [T5] - Cruise Missile status.

The flag symbols are concentrations of Soviet Army units. If any new Soviet units are deployed, they will flash for a time when the Threat screen is first viewed. There may also be a message on the message pad.

This screen only provides information: no icons are available and no selection is required.

11. ATTACK DISPLAY

A Soviet ICBM attack will be displayed on the WORLD screen and will also affect the BORDER DISPLAY.

During normal play, the World screen will "freeze" time and the game calendar will stop. When a Soviet attack occurs, this is no longer the case, and the game will run in a "minutes/seconds" mode regardless of which screen the player selects (except that the attack does "freeze" if you enter the ORBIT screen).

All screens except the R & D screen can be selected as normal. This will enable you to arm the systems if you have not already done so.

The Soviet ICBMs or warheads will appear as dots on the World screen. Any small flashes seen are your systems firing: all your systems coloured yellow in the Orbit Display will fire automatically. The number of Soviet warheads etc. will be shown in the Attack Display. The lower red calendar line will show the time to impact (see Section 4, BORDER DISPLAY).

If the attack looks like penetrating your systems, the President's PHONE icon [C1] will change to a MISSILE icon. This shows that the President is asking you if you can hold off the attack (prevent any warheads falling on America). If you feel that some warheads will get through select the Missile icon (formerly the Phone icon). If you think that your systems will stop the attack, DO NOT select the Missile icon. If you indicate that some warheads will get through, the President will launch the American ICBMs.

These ICBMs cannot all launch within seconds of each other. If you give the President insufficient warning, some or all of the American ICBMs may be caught on the ground. In this case, some or all of the ICBMs may be destroyed.

If an American launch is made, a blue IMPACT BOX will appear on the World screen. This will count the number of nuclear impacts on the Soviet Union. The decision to "approve" a launch or not has a large effect on the player's score.

12. INQUEST SCREEN

At the end of any nuclear attack or exchange, the game will end and the INQUEST screen will be displayed (see Fig. S6), to assess your performance, and how well America and the SDI systems did. The ATTACK DISPLAY will update and show the following details:

- [A1] - Total number of Soviet ICBMs launched.
- [A2] - Number of Soviet ICBMs destroyed by your systems.
- [A3] - Number of Soviet warheads on the ICBMs at launch.
- [A4] - Number of Soviet warheads destroyed by your systems.
- [A5] - Total number of nuclear impacts on America.
- [A6] - Total of those impacts that fell on urban areas.

HIGH FRONTIER INQUEST SCREEN

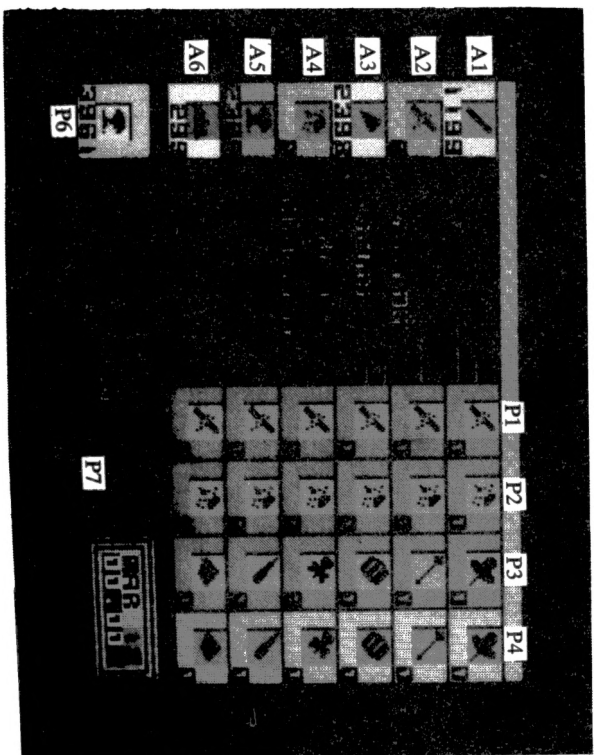


FIG. S6

The **SYSTEM SCORE GRID** will show the effectiveness of each of your systems as follows:

- [P1] - Number of ICBMs the system destroyed.
- [P2] - Number of warheads the system destroyed.
- [P3] - Number of system satellites in orbit at the start of the attack (less any losses due to Soviet counter-measures).
- [P4] - Number of system satellites left in orbit.

NOTE: In the confusion of battle, different systems will sometimes claim the same "kill". Keep this in mind when comparing system performances. The total number of nuclear impacts on the Soviet Union is shown in the lower impact box [P6]. The player's score is displayed lower centre [P7].

To play a new game, press the fire button and the game restart screen is displayed. Press fire again and you will be returned to the Game Selection screen.

13. QUIT GAME

To quit the game you must first make sure that the command cursor is "active"; that is, you must be able to move the command cursor along the command icons. This happens normally when you are selecting different screens. If the command cursor is active, pressing the Q key will break out of the game.

14. ORBIT SCREEN

There are two methods of entering the ORBIT SCREEN.

METHOD A: If you have some system satellites in orbit during a game, enter this screen by selecting the JOYSTICK icon on the SDI Command screen.

METHOD B: Select ORBIT when on the Game Selection screen. This enables the player to practice/play the Orbit screen with the game set up in a special way, as follows:

1. Ten satellites of each system are already built and in orbit.
2. All systems are armed.
3. A Soviet attack is taking place.
4. The player starts on the SDI Command screen.

This is a special set-up and a normal game CANNOT be played from this position. When the player exits from the SDI Command screen, the game will restart on the Game Selection screen. Apart from these exceptions, all the subsequent information in this section applies.

Entering the Orbit screen (see Fig. S7) gives you manual control of one satellite of the system you have chosen. In the case of manned systems (ie the Space Plane), it is a view from the cockpit. For all the other systems it is a view of the manual control console at the SDI COMMAND CENTRE on Earth. The central "view" is given by a video camera on board the satellite in orbit.

To be able to go to the Orbit Screen you must have at least one satellite of the system in orbit. In order to fire any weapons on the satellite, the system must be armed. If the Soviets have not launched an attack, there will be nothing to fire at!

The central view shows the Earth below and stars, targets and so on rising from the horizon. The video image is subject to electronic processing before being

displayed, so the Earth and stars are faded and the targets are brightened. Targets can also be detected by their changing positions relative to the stars.

The top right display box [N12] is the type of system for which you have manual control. The boxes below this show the number of missiles [N10] and warheads [N11] you have destroyed so far.

The number below the lightning flash symbol [N13] is the fire power remaining in the main weapon.

Below this are the two displays for the Target Type Computer. This uses radar and data from other satellites to give warning of approaching targets. Large targets are classed as missiles and the number of these targets is shown in the Missile Target Display [N9]. Smaller targets are classed as warheads and their number is shown in the Warhead Target Display [N8].

At the bottom of the screen is a row of command icons. You can select these as normal. All systems have the following command icons and display:

[N1] WORLD

When selected, the player is returned to Earth!

[N2] SLAM

Arms the SLAM missiles, of which there are two on the space plane.

[N3] MAIN WEAPON

Selecting this will arm the satellite's main weapon. Note that the main weapon type will vary according to the system you have selected.

[N4] X-RAY LASER

Arms and launches the X-RAY LASER device. The space plane carries only one of these.

[N5] CAMERA

This causes the Optical Image system to compare the image of the target with patterns stored in its memory. It will display the closest match on the Image Display [N6].

[N7] MESSAGE DISPLAY

Displays messages such as "Weapon Armed".

The space plane is unique in that it also has two other types of weapons in addition to the main armament. The extra command icons are:

15. WEAPON TYPES AND CONTROL

Each type of weapon has different controls. When a weapon is armed, the Aiming Sight will normally appear on the screen. To exit from controlling the weapon, move the sight to the bottom of the view screen and press the fire button. The joystick will then be back in control of the Command Cursor. The one exception to this system is the X-RAY Laser device, which does not have an aiming sight. Control will automatically return to the command cursor after detonation.

NOTE: The weapon graphics [D11-D14] are shown in Fig. S2 (SDI Command screen).

HIGH FRONTIER ORBIT SCREEN (SPACE PLANE)

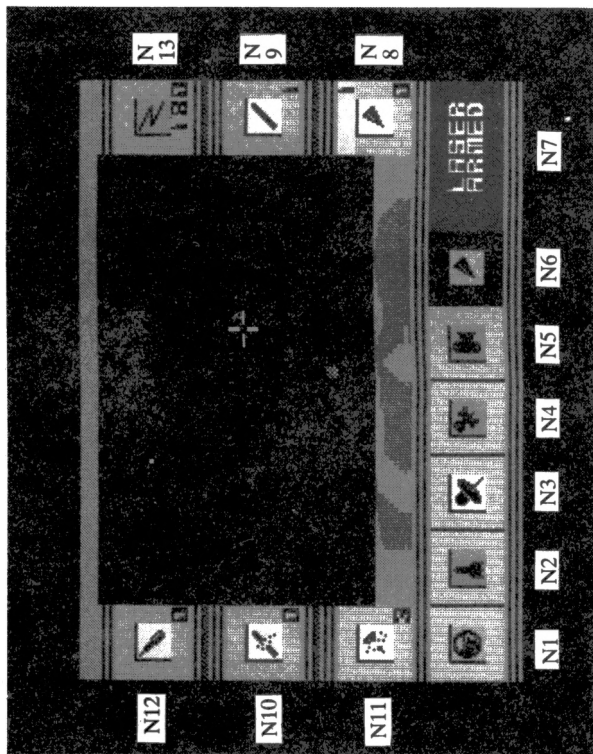


FIG. S7

[D11] LASER

A high-energy pulse laser fitted to the Laser system and the Space Plane system. The Laser Satellite system has energy for 220 “shots” - the Space Plane version has 200 “shots”. Aim with the sight and press the fire button to fire. Single target capability.

[D12] RAIL GUN

An electromagnetic rail gun with 250 rounds of ammunition. Aim with the sight and press the fire button to fire. Single target capability.

[D13] SLAM

The Satellite Launched Attack Missile is a solid-fuel missile with an advanced laser tracking system, and is a true fire-and-forget weapon. It is unusual as it can kill its target in two distinct ways (see Section 24, SDI SYSTEMS (IN THE GAME)). After the SLAM system is armed, it will automatically track your aiming sight. If it can “see” a target in the aiming sight, it will launch and attack the target. Once the SLAM ARMED message is displayed, no further presses of the fire button are needed. Single target capability.

[D14] X-RAY LASER

A multiple X-Ray Laser with a nuclear bomb as its power source! This is a fire-and-forget weapon with a manual override. When you select the weapon, it will arm and launch automatically. Then the yellow X-Ray target count display [N14] will appear, which indicates how many targets the laser is currently “locked” onto. This number will change as the device acquires or loses targets. After a set time, the device will detonate and destroy the targets it is locked onto. If, however, the fire button is pressed again after launch, the device will immediately detonate. This is useful if the weapon has locked on to all targets: that is, the number shown in the Target Count Display equals that in the Warhead Target Display [N8] or Missile Target Display [N9]. Multiple target capability.

NOTE: X-RAY LASER WARNING

The device will detonate automatically at a safe distance from the launch craft, but if manual override is used it is possible that the nuclear explosion will destroy the launch craft. If this is an X-Ray Laser armed satellite it doesn't matter, since the launch craft is useless once the device is released. When the launch craft is the Space Plane, it WILL matter!

16. ORBIT SCREEN GAME LEVELS

The Game Level set on the Game Selection screen will apply to the Orbit screen, so whether the Orbit screen is entered during the main game or by selecting GO ORBIT, the following will apply:

- EASY LEVEL** - Low numbers of decoys with warheads. Missile-type targets are always missiles
- NORMAL LEVEL** - More decoys, and missile-type targets that are not missiles
- HARD LEVEL** - Still more decoys, and “friendly craft”.

For further information on system weapons, see Section 24, SDI SYSTEMS (IN THE GAME).

17. STAFF SERGEANT RAVENHALL'S BRIEFING PILOTS' AND OPERATORS' EYES ONLY

"Gentlemen, starting today you will assume command of a multi-million dollar weapon system. The purpose of this briefing is to assist you in making the most effective use of said system.

We will first turn our attention to the targets you are likely to be faced with. The Target Type Computer splits the targets into two sorts - warhead, or missile types.

First we will consider warhead type targets. These may be either genuine warheads, or decoys. Unfortunately, the Optical Image System cannot tell the difference between a warhead and a decoy. However, a hit on a warhead will cause an explosion which you should be able to see. A hit on a decoy will not result in an explosion.

The older Soviet MIRV warheads have no decoys, so if you see one warhead-type target, it is not likely to be a decoy. Newer Soviet MIRVs have one or more decoys in attendance, so if you are faced with a cluster of targets, just keep firing until one explodes. Do not leave them for someone else! There may be no-one else and the warhead's target could be your home town.

The only exception to this rule is if the intelligence reports of the RED SHOAL are true. This is supposed to be a timed Soviet launch which will put a swarm of MIRVs and decoys into a small area. Obviously single-target capable weapons will be ineffective against this, so if you only have single-target weapons, let the shoal go. Operators with the multi-target capability weapons should make the RED SHOALS (if they exist) their prime target.

The other main target type is missiles. However, when the Target Type Computer shows missiles, don't take it as gospel - all that the computer really knows is that the target is too big to be a warhead or a decoy. Use your Optical Image system to check it out: the system will show a missile match if the target is either a missile or a MIRV bus. Kill either on sight!

There are one or two problems associated with missile-type targets. Rumour has it that the Soviets have developed some sort of "space mine" that can destroy a satellite or space plane. Our "experts" think that this is beyond the Soviet's technology - so it's better than even money that you'll come across them! Be warned.

The PX grapevine also reports that our friends in the Company may have manned satellites in orbit, so watch who you're shooting at!"

18. FAMILIARISATION

At this point the player is advised to play a few games until he becomes familiar with the mechanics of the game. You will find the game easier to play than you might expect from reading the manual so far!

There is no need to access the Orbit screen as the game will play without this being used. Conversely you can play the Orbit screen without playing the main game, although this is pointless except for practice. When you feel at home with the game system, read the following sections.

19. BASIC TACTICS (EASY LEVEL)

R & D SCREEN

Your aim should be to build a few systems up to full strength before the Soviets attack. A system is at full strength when you are paying maintenance costs. Do NOT attempt to build all six systems at once - it CANNOT be done. Pick the systems you wish to build and stick at it. Spraying money and people haphazardly around the projects is a waste of time and resources.

SDI COMMAND SCREEN

When the system satellites have been built, launch them into orbit. If the Soviets are massing on NATO's border and you have 200 satellites on the ground, then you have a problem! Do NOT arm the system before the President tells you to (on this level, he ALWAYS will). Also, unless you are a reasonable arcade player, keep off the Orbit Screen - you will only waste systems.

ESPIONAGE SCREEN

On the EASY level this has no real importance.

THREAT SCREEN

Watch the Soviet build-up late in the game and learn to judge when an attack is coming.

PRESIDENT'S MESSAGES

ALWAYS answer the phone! The game is designed to punish players who do not do this. When you have struggled and scraped to build some decent systems, it is not a happy discovery to find that you have missed the ARM CODE message and cannot activate them.

Most players should learn how to win every time on the EASY level.

20. NORMAL & HARD GAME LEVELS

These levels introduce new factors into the game. The main ones which will be apparent to the player are given below, but there are others...

- 1) The number of warheads carried by Soviet ICBMs will rise.
- 2) Your systems in orbit will no longer be safe from attack or interference by Soviet counter-measures.
- 3) The President will no longer have a god-like powers which enable him to always predict an attack, so the President's ARM message may not appear.

21. PRESIDENT AND SOVIET LEADER TYPE

Different combinations of these types will produce differing effects, which you will recognize with experience. It should, however, be obvious that a simulation involving two "hawks" will not normally last very long, also, a "hawk" president will spend more on weapons than a "dove".

22. THE GAME IN DEPTH

The earlier sections gave an explanation of the game mechanics. For the sake of simplicity some of the sections did not go into the game in any depth. The following section will fill in the missing details and provide some hints on playing.

R & D

The main problem is how to get enough money and manpower to complete a project. First, the money aspect.

As the president controls the purse strings, you should pay careful attention to what you tell him. If, in reply to the question "How many warheads will the system destroy?", you continually answer 0% or some low figure, the President may begin to lose faith in the project.

On the other hand, if you happily bang in very high figures every time, the decision may be made that the system is now effective and less money will be needed in the future.

The manpower problem is tackled in a different way. As mentioned earlier, you only have direct control over Government employees, who are shown in white. The other people are free agents, not under direct Government control. However, they are attracted to projects that have large amounts of money. Sometimes it is worth giving more money than is required to a project, simply to keep or attract free agents.

Applying more money or manpower than required to a project will not speed up development: any extra money will be spent on the completion of a project phase ("Hey Joe! There's five million dollars left. How about one of those Cray computers we always wanted to look at?").

If a system is partly complete, with satellites in orbit, and you stop giving the project any money, the satellites will start to fail in orbit. This will also happen if you fail to pay the maintenance costs after a system is complete. However, there is one system (the Space Plane) that will repair other systems in orbit. It will do this as part of its training missions, so money does not have to be spent maintaining other systems.

SDI COMMAND

The different systems in the game do not have their own launch vehicles. The player has a fixed launch capacity of ten satellites per month (if there are problems, even less). The game has a Launch Priority List, so that if two systems both have satellites on the ground AND their Launch Commands are set, the system with the highest priority will be launched first. After ALL this system's satellites are in orbit, the next system's satellites will be launched, and so on. The Launch Priority List order is shown by the Orbit Display boxes: the system in the top box (Laser) has the highest launch priority, that in the bottom box (Battle Management) has the lowest. Careful choice of launch commands will prevent this from being a problem.

SOVIET COUNTER-MEASURES

On the higher game levels, the Soviets will develop counter-measures against the SDI systems - but only against systems that are deployed in orbit. This makes the timing of system deployment an important decision. Most counter-measures will destroy system satellites: there is, however, a more subtle method which will interfere with the SDI Commands. One system is proof against this and provides a way around the problem.

If the Soviets are developing counter-measures, it is vital that you keep an eye on their program.

SYSTEM SELECTION

If you constantly watch swarms of Soviet warheads impacting at the end of games played at HARD level, I offer the following final points:

- 1) Try to build a set of systems that complement one another. Copy the concept of a "layered defence" outlined in the SDI CONCEPT section.
- 2) Systems that are armed fire immediately and use up their resources whether or not they are effective at the time!

23. SDI SYSTEMS (IN THE GAME)

All the SDI systems depicted in the game are being developed, tested or studied, though we admit the SLAM system is a touch more advanced than the proposed one! The system graphics are shown in Fig. S2.

[D11] LASER SYSTEM

This is composed of satellites carrying high-energy lasers. The electric power is provided by [CENSORED] units. During operation, these units produce a ringing sound: giving rise to the system's popular name, "Dead Ringer". Each satellite has a high KC (Kill Capacity) against both missiles and warheads. A complete system will contain 100 satellites.

[D12] ELECTROMAGNETIC RAIL GUN SYSTEM

The satellites are equipped with electromagnetic guns which fire solid "shells" at velocities of over 40 miles per second. Electrical power is taken from explosive charge generators, with vapourising liquid nitrogen used to cool the barrel and feed the ammunition. Each satellite has a low KC against missiles and a normal KC against warheads. The complete system consists of 180 satellites.

[D13] MULTI SLAM SYSTEM

Each satellite of this system carries 64 SLAMs - Satellite Launched Attack Missiles - which incorporate a number of unusual features. The solid fuel motor provides propulsion and generates electrical power, which powers the nose-mounted laser used for target tracking. While fuel remains in the motor, the missile will attempt to kill the target with a direct hit. Once the fuel is exhausted, the remaining energy is expended to overload the laser, firing a final high energy pulse at the target which may destroy it. The system has a high KC against missiles and a low KC against warheads. The complete system contains 250 satellites.

[D14] X-RAY LASER SYSTEM

The satellites of this system each carry one X-ray laser device. The computer on board the satellite tracks all targets, passing targetting information to the X-ray device via an ultra-high speed data link. Under manual control, these transmissions are fed to the operator as sounds, to warn that the device is armed and launched. Each device consists of a small nuclear bomb and bundles of lasing rods. Each lasing rod is allowed to "float" between aluminium rings, and is aimed by varying the electrostatic charges on these rings. When the device is detonated, it is destroyed in

a millionth of a second; however, the energy produced causes each rod to transmit an X-ray laser pulse before it is vapourised. Although the pulses last for only a few billionths of a second, they carry energy in excess of a trillion watts! Each satellite has a low KC against missiles and a superb KC against warheads. The complete system contains 60 satellites.

[D15] SPACE PLANE SYSTEM

This system's "satellites" are manned vehicles best described as a cross between a mini shuttle and a fighter aircraft. In the "War Mode" the single pilot has an array of weapons to choose from, including lasers, X-ray lasers and SLAMs. The SLAMs and X-ray devices use the standard piston launch technique, where each weapon is contained in a launch tube. Behind the weapon is a piston, which is moved forward to eject the weapon by vapourising nitrogen to create pressure. In addition, the piston is trapped at the end of the tube and the gas exhausted via a nozzle at the rear of the launch tube: this helps to cancel some of the "launch recoil" which tends to destabilise the launch vehicle. (These pistons are also standard equipment on all SLAM and X-ray systems, and can be noted by their characteristic "hiss" on launching). Each space plane has a low KC against missiles and a normal KC against warheads (this, however, depends on the pilot's ability).

In the "Repair Mode", the space plane can carry a second crew member and other equipment.

[D16] BATTLE MANAGEMENT SYSTEM

This is really a collection of systems which include battle management satellites, computer systems, communication systems and Anti-Ballistic Missile (ABM) systems. The system's KC against both missiles and warheads is poor; however, this is the only system which will attack warheads that have entered the Earth's atmosphere (using the ABMs). The ABMs have a high KC against incoming warheads.

The communication systems are computer-controlled, and messages or commands are very secure from decoding or jamming. This is achieved by various means, one of which is that each message contains a new code to be used for the next message. If the Battle Management system is built, it can be used to control other system. The complete system contains 100 "satellites". This is simply a measure of the system's "completeness" and not, in fact, the number of satellites or ABMs in the system.

24. SDI EXPLAINED

SDI is aimed at defeating a Soviet (or other) ICBM attack on the American mainland. ICBMs are long range missiles equipped with nuclear warheads, usually launched from silos buried in the ground, or from submarines beneath the sea. After launch the missiles climb into space and release their payload, normally called a "bus" (with nuclear warheads as passengers!). The bus launches the warheads, known as MIRVs (Multiple Independently-targetable Re-entry Vehicles), towards their targets while above the atmosphere: the MIRVs then fall back into the atmosphere and explode on or near their targets. (More advanced MIRVs called MARVs, can take avoiding action to fool defence systems). It would normally take around 30 minutes from launch to impact. The Soviet Union and America both have over a thousand ICBMs.

THE PROBLEM

The deployment of these weapons by both sides has led to an uneasy stalemate. Both sides know that a surprise attack (First Strike) could not ensure that all the enemy ICBMs could be destroyed, and the enemy counterstrike would cause unacceptable damage. This became known as MAD, Mutually Assured Destruction. For a brief period, both sides experimented with the idea of ABM defences. The technical problems and costs at that time led to the SALT talks, which effectively prevented the wholesale deployment of ABMs (some people were also rather puzzled as to the difference between an enemy warhead exploding over their city, and multiple nuclear explosions overhead caused by "friendly" ABMs).

However, there had always been plausible arguments for constructing a defence against ICBMs: to help ensure the safety of our own ICBMs against an enemy First Strike; taking care of a missile launched by mistake; stopping any small country with a lunatic in charge going too far, and so on - not to mention "The enemy is developing it, so we must too".

THE CONCEPT

One of the main principles of SDI is that of a "layered defence". This means that, if the defence is created in layers, each layer does not have to be 100% effective. With a three-layer defence in which each layer is only 50% effective, the final percentage of warheads getting through would be 12.5%. If the layers were 90% effective, only 0.1% would impact - and an attack of 5000 warheads would result in only 5 nuclear explosions. The various layers are as follows.

FIRST LAYER

When an ICBM is launched, its motors will burn for three to five minutes. It rises slowly at first and then picks up speed as it climbs into space.

The advantages of killing a missile at this stage are:

- 1) While the motors are firing they produce an easily-detectable heat source, so finding the missiles is relatively easy.
- 2) At this stage the missile's structure is subject to high stresses, making it easier to destroy.
- 3) The MIRV warheads are all still on board the bus in the missile's nose cone, so killing one missile could destroy ten or more MIRVs.

The disadvantages are:

- 1) The missile is shielded to some extent by the Earth's atmosphere and magnetic field, both of which interfere with various SDI weapons.
- 2) Time: you have only five minutes to detect the attack, report this to command, receive a command decision to fire, commence firing and kill the missiles (this assumes that the SDI weapons will not automatically "fire on sight").

SECOND LAYER

After the missile has cleared the Earth's atmosphere, the nose shroud is jettisoned. The bus then starts to deploy MIRVs, decoys and other "penetration aids".

The main advantages are:

- 1) The attack has been in progress for five minutes before this stage, so ample warning has been given. This phase also lasts over 20 minutes, so there is time for tracking, sorting and firing.
- 2) The warheads are now in the vacuum of space, so weapons that were ineffective in the atmosphere are now much more destructive.

The disadvantages are:

- 1) You now have multiple targets -ten or more MIRVs instead of one missile.
- 2) It is easy for the MIRVs to be hidden among groups of decoys. The favoured technique is for the MIRV to inflate metal balloons and build a decoy group around itself - it also inflates another balloon around itself. To radar and optical methods, all the balloons appear identical. There are, however, proposed methods for getting over this problem, one being to "tap" the balloon with a laser. The balloon carrying the warhead would be heavier and not move very far, but the lighter decoy balloons would move further (this is a major simplification!).

THIRD LAYER

The warheads now re-enter the Earth's atmosphere and fall on their targets.

The advantages at this time are:

- 1) The atmosphere will filter out most of the decoys.
- 2) After tracking the MIRVs for over 20 minutes, you will be in a position to predict their flight path (MARVs excepted!).

The disadvantages are:

- 1) Time: you now have less than five minutes to destroy the MIRVs.
- 2) As they approach their targets, the choice of weapons available becomes limited. Nuclear-armed ABMs may damage whatever you are trying to save (this is not strictly true with well-protected military targets).

25. NOTES ON THE SIMULATION DESIGN

The main distortion in the game is on the Orbit screen, where the normally invisible and instantaneous laser shots are depicted as visible "pulses". Although there are no dust or water vapour particles to scatter the laser's light in the vacuum of space, the "arcade" laser shots were included because a true simulation of the real thing simply looked wrong. The SLAM missiles DO fire "real" lasers at the end of their powered flight, and you can see how strange this looks if you hit targets at either screen edge.

Some other design aspects caused difficulty. An SDI simulation has an obvious ending, but no beginning or middle. Even the ending raises problems, because by its very nature an SDI system must be automated, so the final battle is beyond human control and influence.

The R & D screen is an attempt to give the player some influence in this final battle. The correct choice of systems and careful development will pay its own rewards. To introduce an element of uncertainty, the project costs will vary slightly from game to game; likewise, the launch rate and Soviet counter-measures are variable.

Obviously the number of systems in orbit is a simplification. In reality, not all the systems in orbit would be in a position to fire at one attack. This availability is dependent on orbital heights and weapon ranges: however, we felt that players new to wargaming would have enough on their plate as it was.

The number of Soviet missiles and warheads is also lower than is probably true, but we felt that this was not important in the context of the game.

The obvious absurdity of the President issuing the ARM/DISARM codes once is a ploy to ensure players answer his messages. In real life, we can't see anyone ignoring a Presidential phone call!

26. BIBLIOGRAPHY

Anyone seeking further information on the subject of SDI will find the following books of interest. For a general introduction, David Hobbs' excellent book is recommended.

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