STARSHIP 1

Operation, Maintenance and Service Manual
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A. INTRODUCTION

Atari's Starship 1™ is a futuristic one-player computer-controlled game that simulates space flight. The object of the game is to destroy alien spacecraft while maneuvering through star and asteroid fields. A player's score is determined by the number of alien spacecraft destroyed.

You, the owner of Starship 1, have options available in the game. The options are for the number of coins necessary to play the game and whether or not extended play is awarded. These options are selected by removing the game printed circuit board from the metal RF box and setting switches as desired.
Standup 1. We all know that video games have a soft place in the hearts of many, but a software defect that occurs approximately 7% of the time could be dangerous. By targeting the soft defect, you can determine if the game is not operating properly.

B. GAME INSPECTION

Your new Standup is manufactured by Atari with the intent of being ready to play right out of the shipping box. However, before we can be sure that the product delivered stands up to your expectations, we need your cooperation in satisfying the last step of your purchase. Therefore, we ask you to follow the procedures below to ensure that you are getting the quality of game that you expect from Atari.

1. Examine the exterior portions of the game cabinet for damage, chips, or broken parts. If you have purchased this game as a new unit, make sure that it looks new.

2. Examine and open the rear access door. Examine the interior of the game cabinet for anything that appears broken or out of place.

C. INSTALLATION

REQUIREMENTS

All special requirements for the installation of the game are listed as follows:

Power Requirements:

After you have plugged in the power cord for the game and have plugged in the power supply, check for a voltage of 220 VAC. After the power supply is on, check for a voltage of 120 VAC.

Temperature Range:

Operation and storage temperature ranges should be no lower than 45 degrees Celsius (110 degrees Fahrenheit) and no higher than 95 degrees Celsius (203 degrees Fahrenheit).
Humidity Range:
Location and storage relative humidity should be no more than 95%.

Location Space Required:
Starship 1 requires a minimum of 185 centimeters (73 inches) of vertical clearance, a minimum of 75 centimeters (29.5 inches) of width clearance, and 152 centimeters (60 inches) of depth clearance. Depth clearance includes 61 centimeters (24 inches) of minimum player space.

Length and Type of Power Cord:
Atari has added a 1.83-meter (six-foot) strain relief power cord to Starship 1. The advantage of the strain relief cord is that if someone trips over the cord, the cord will break off just inside the game cabinet. Tripping over a non-strain relief cord may result in ripping out the inside of a game.

D. INTERLOCK AND POWER ON/OFF SWITCHES
Atari has two concerns that resulted in our installing two on/off switches, as illustrated in Figure 2. The first concern was to minimize the hazard of electrical shock while you are working inside the game cabinet. Therefore, we installed an interlock switch on the rear access door frame that completely removes power from the game when the access door is open.

Our second concern was energy conservation. A power on/off switch has been added to Starship 1 so that the game can be turned off during low business periods and closing hours. This switch is conveniently hidden on the right side of the top panel, near the rear of the game cabinet.

Please check for the proper operation of the rear access interlock switch by performing the following:
1. Unlock and open the rear access door.
2. Plug the AC power cord into a 110-volt source. (If the voltage is less than 100 VAC, make sure that the voltage plug is changed to the black plug.)
3. Set the power on/off switch to the on position by flipping the toggle switch toward the front of the game cabinet.
4. Close the rear access door. Within approximately thirty seconds the TV monitor should display a picture.
5. Slowly open the rear access door until the TV monitor picture disappears. The TV monitor picture should disappear when the rear access door is opened to less than one-inch at the top of the door.
6. Close and lock the rear access door. If the results of Step 5 are OK, then the interlock switch is operating properly. If not OK, check to see if the switch is broken from its mounting or stuck in the on position.

E. SELF-TEST PROCEDURE IN TABLE 1
Starship 1 will test itself and provide data to communicate with you that the game's circuitry and controls are working properly. We suggest that you do the Starship 1 Self-Test Procedure each time you empty the coins from the game's cash box.

There are three tests performed with the self-test switch on. The first test is done completely by the Starship 1 computer. In this test, the computer determines if its memory is OK. In the second test, you activate each switch to determine if they are operating properly. In the third test, you move the control yoke to determine if it is operating properly.

The fourth test is performed with the self-test switch in the off position. In this test you determine if the coin acceptors are operating properly.

Perform the Self-Test by following the instructions of Table 1.

F. OPERATOR OPTIONS IN TABLE 2
At this time, decide what options are best suited for your location of the Starship 1 game. The coinage options on Starship 1 are 2 games per coin, 1 game per coin, or 2 coins per game. Starship also has a time option ranging from a one-minute to a one-and-one-half-minute game.

Set the options of the game as described in Table 2. Refer to Figure 3 for the location of the option controls.

If you decide to have a bonus time option, install the BONUS TIME player notice (comes in poly bag with new game) on the bezel immediately inside the game cabinet above the player controls. Refer to Chapter 3 for instructions for the removal of the front housing assembly.
<table>
<thead>
<tr>
<th>Test</th>
<th>Instruction</th>
<th>Results if Test Passes</th>
<th>Results if Test Fails</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unlock and open Coin Door. Set Self-Test slide switch (located inside and to the left of the Coin Door) to the on position.</td>
<td>TV monitor displays almost anything that is normal for the attract or play mode. <em>Test tone is always present from both speakers during Self-Test 1.</em></td>
<td>TV monitor displays the words BAD ROM followed by a number.</td>
</tr>
<tr>
<td></td>
<td>If test fails, record the BAD ROM number, shut off the game, call your distributor and tell him the ROM failure number.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>Note to Distributors: BAD ROM 0 indicates a failure of PROM 1 (location C/D1) or PROM 2 (Location C/D2).</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAD ROM 1 or BAD ROM 2 indicates failure of ROM 8 (location F3).</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAD ROM 3 or BAD ROM 4 indicates failure of ROM 4 (location H3).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Press START pushbutton. Press PROTON TORPEDOS pushbutton. Set THRUST CONTROL to SLOW. SET THRUST CONTROL to FAST.</td>
<td>Test tone volume increases. Test tone volume increases. Test tone frequency is lower than when control is in FAST position. Test tone frequency is higher than when control is in SLOW position.</td>
<td>Test tone remains the same. Test tone remains the same. Test tone remains the same. Test tone remains the same.</td>
</tr>
<tr>
<td>3</td>
<td>Turn control yoke to left and down, then turn to right. Pull control yoke up.</td>
<td>Test tone frequency increases as control yoke is turned from left to right. Test tone frequency increases as control yoke is moved from downward position to upward position.</td>
<td>Test tone remains the same. Test tone remains the same.</td>
</tr>
<tr>
<td>4</td>
<td>Set Self-Test slide switch to off position. Trip and hold in the tripped position each of the coin mechanism trip wires.</td>
<td>TV monitor displays the word COIN as long as one of the coin mechanisms trip wires is held in the tripped position.</td>
<td>No change in the TV monitor.</td>
</tr>
</tbody>
</table>
NOTE
There are six potentiometers on the Starship 1 Game PCB. Ensure that you know which potentiometer you are adjusting. Adjusting the incorrect potentiometer may cost you money.

G. VOLUME CONTROL
If volume is incorrect for your location, remove the game PCB and adjust the volume to your desire. See Figure 3 for the location of volume control.

Figure 3  Location of Game Time and Volume Adjustments
Table 2  Option Switch Settings

<table>
<thead>
<tr>
<th>Option</th>
<th>Option Switch Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C</td>
</tr>
<tr>
<td>2 Plays Per Coin</td>
<td>OFF</td>
</tr>
<tr>
<td>1 Play Per Coin</td>
<td>ON</td>
</tr>
<tr>
<td>2 Coins Per Play</td>
<td>ON</td>
</tr>
<tr>
<td>No Bonus Time</td>
<td>ON</td>
</tr>
<tr>
<td>Bonus Time</td>
<td></td>
</tr>
</tbody>
</table>
During game play, Starship 1 can be described as operating in any of three modes: attract, ready-to-play or play mode.

**A. ATTRACT MODE**

The attract mode begins with the application of power and ends when the proper amount of coins are accepted. During the mode, the T.V. monitor displays four one-line messages. The first line indicates the last player’s score and number of crashes. The second line appraises the previous game performance (for example, YOU HAVE SAVED THE FEDERATION or YOU HAVE LOST EVERYTHING). The third and fourth lines are an instruction for the player to deposit a coin to be in command of Starship 1.

Throughout this mode, all controls are inactive.
B. READY-TO-PLAY MODE

This mode begins when the proper number of coins are accepted and ends when the START button is pressed.

During this mode, the TV monitor displays the following message:

YOU ARE IN COMMAND
PRESS START FOR NEXT MISSION

Throughout this mode, all player controls are inactive.

C. PLAY MODE

This mode begins with pressing the START pushbutton and ends when the game time runs out. Throughout this mode, all player controls are active.

The THRUST CONTROL sets the speed at which the displayed space objects move towards the player. This can be changed from SLOW to FAST or from FAST to SLOW anytime during the game mode.

The player has two ways of destroying alien spacecraft to earn game score points. One way is to line up an alien spacecraft in the laser sights (X mark on TV monitor screen) and then press one of the laser activator pushbuttons located on the end of each handle of the control yoke. The other way of destroying alien spacecraft is to press the PROTON TORPEDOS pushbutton. This results in destroying all alien spacecraft that are displayed on the TV monitor. This second method is obviously easier, but a player is limited to five proton torpedos per game.

The control yoke operates just like in an airplane. To operate the control, the player must imagine being in Starship 1 and flying toward the targets. To go up, the player must pull down on the control yoke. To go left, the player must turn the control yoke to the left.
MAINTENANCE AND ADJUSTMENTS

Due to its solid-state electronic circuitry, this Atari unit should require very little maintenance and only occasional adjustment. Information given in this chapter and elsewhere in the manual is intended to cover most servicing situations that may be encountered at the game site. The procedures given are in sufficient detail to be understood by a person with moderate technical ability.

NOTE

If reading through the manual does not lead to solving the specific maintenance problem, you can reach Atari's Customer Service Department by telephone (open Monday through Friday, 7:30 am to 4:30 pm Pacific Time):

from outside California (800) 538-6892 (toll-free)

from inside California (408) 984-1900

For those interested in gaining more information on video game technology, especially the electronics, we recommend reading the Video Game Operator's Handbook, manual no. TM-043. This book is available from Atari, Inc., attn. Customer Service Dept., 2175 Martin Avenue, Santa Clara, CA 95050 for $5.00 each, or from your distributor.
A. CLEANING

The exteriors of game cabinets and plexi panels may be cleaned with any non-abrasive household cleaner. If desired, special coin machine cleaners that leave no residue can be obtained from distributors. Do not dry-wipe the plexi panels because any dust on the surface can scratch the surface and results in fogging the plastic.

B. COIN MECHANISM

Components On Coin Door

Figure 4 shows the back side of the coin door assembly where the game’s two coin mechanisms are mounted. Included is the lock-out coil assembly; the lock-out wires are connected to this assembly but are hidden behind the coin knobs. During the attract mode the microcomputer energizes the lock-out coil, causing the lock-out wires to retract far enough to allow genuine coins to reach the coin box. But during the ready-to-play mode when the LED is lighted and during the play mode and also when AC power to the game has been turned off the lock-out coil is de-energized, causing the lock-out wires to move out far enough to divert coins over to the return chute.

Directly below each coin mechanism is a secondary coin chute and a coin switch with a trip wire extending out to the front edge of the chute. When the trip wire is positioned correctly, a coin passing down the secondary chute and into the coin box will momentarily push the trip wire down and cause the switch contacts to close.

Also shown in the photograph is a slam switch assembly. It has been included to detect any players who might try to obtain free game plays by violently pounding on the coin door to momentarily close the contacts on a coin switch. The slam switch contacts connect to the microcomputer system, which will ignore coin switch signals whenever the slam switch contacts are closed.

Access To Coin Mechanisms

To remove jammed coins, and for maintenance cleaning, each magnet gate assembly can be hinged open without removing it from the door, as shown in Figure 5. Or, if necessary, each coin mechanism can be entirely removed from the door merely by pushing
down on a release lever and simultaneously tilting the mechanism back, then lifting it up and out. This is shown in Figure 6.

**Figure 6  Removal of Coin Mechanism**

**Cleaning of Coin Paths**

**CAUTION**

*The use of an abrasive (such as steel wool or a wire brush) or a lubrication on a coin mechanism will result in a rapid build-up of residue.*

By talking to many operators, we have found that the best method of cleaning a coin mechanism is by using hot or boiling water and a mild detergent. A toothbrush may be used for those stubborn buildups of residue. After cleaning, flush thoroughly with hot or boiling water, then blow out all water with compressed air.

Figure 7 shows the surfaces to clean inside the coin mechanism. These include the inside surface of the mainplate, and the corresponding surface of the gate assembly. There may also be metal particles clinging to the magnet itself. To remove these you can guide the point of a screwdriver or similar tool along the edge of the magnet.

**Figure 7  Surfaces to Clean Inside the Coin Mechanism**

If coins are not traveling as far as the coin mechanisms, you will need to clean the channel beneath the coin slot. To gain access to this channel, use a ¼-inch wrench and remove all three nuts that secure the cover plate (refer to Figure 8). Removing the plate will provide access to the entire channel.

**Figure 8  Removal of Plate Covering Rear of coin slot**

Also clean the inside surfaces of the secondary coin chutes, but when doing this be careful not to damage or bend the trip wires on the coin switches.

**Lubrication.** Do not apply lubrication to the coin mechanisms. The only points that may need lubrication (and only rarely) are the shafts of the scavenger buttons (coin rejection buttons) where they pass through the coin door. Apply only one drop of light machine oil, and be positive that no oil drops down onto a coin mechanism. Figure 9 shows this lubrication point.

**Figure 9  Lubrication Point**
Kicker and separator
1. Set the acceptor with the back of the unit facing you in the test position.
2. Loosen the kicker and separator screws (1) and move the kicker (3) and the separator (4) as far to the right as they will go. Lightly tighten the screws.
3. Insert several test coins (both old and new) and note that some are returned by striking the separator.
4. Loosen the separator screw and move the separator slightly to the left. Lightly retighten the screw.
5. Insert the test coins again and, if some are still returned, repeat Step 4 until all the coins are accepted.
6. Loosen the kicker screw and move the kicker as far to the left as it will go. Lightly retighten the screw.
7. Insert the test coins and note that some are returned.
8. Loosen the kicker screw and move the kicker slightly to the right. Lightly retighten the screw.
9. Insert the test coins again and, if some are still returned, repeat Step 8 until all the coins are accepted.
10. Be sure that both screws are tight after the adjustments have been made.

Magnet gate
1. Set the acceptor with the front of the unit facing you in the test position.
2. Turn the magnet gate adjusting screw (16) out or counterclockwise until none of the coins will fit through.
3. With a coin resting in the acceptor entrance, turn the adjuster in or clockwise until the coin barely passes through the magnet gate.
4. Test this adjustment using several other coins (both old and new) and, if any fail to pass through the magnet gate, repeat Step 3 until all the coins are accepted.
5. Fix the magnet gate adjusting screw in this position with a drop of glue.

Additional Cleaning
1) Remove the transfer cradle (12) and the undersize lever (14).
2) Use a pipe cleaner or similar effective cleaning tool to clean the bushings and pivot pins.
3) Replace the transfer cradle and the undersize lever.
4) To be certain the coin mechanism is completely free of any residue, place the mechanism in a solution of boiling water and mild detergent for several minutes. Carefully remove it and let it air-dry completely before reinstalling in the door.

Figure 11 Adjustments on Coin Mechanism
Adjustment of Coin Switch Trip Wire

In order for a coin switch to operate reliably when a coin travels down the secondary coin chute, the rest position of its trip wire should be as shown in Figure 10. Use extreme care when handling or touching these wires.

Mechanical Adjustments on Coin Mechanism

Coin mechanisms are adjusted prior to shipment from the factory, and normally will retain these adjustments for many months. If, due to wear or other causes, it becomes necessary to make new adjustments, remove the coin mechanism from the coin door. Then take it to a clean, well-lighted area where it can be placed in a vertical position on a level surface (such as a bench top). Besides a screwdriver, you will need a set of several coins, including both new and old, worn ones. Figure 11 shows an exploded view of the mechanism and gives procedures for adjusting the kicker, separator, and the magnet gate. These adjustments should only be done by someone who has experience in servicing coin mechanisms and who understands their operation.

General Troubleshooting Hints

The first action is to look for jammed coins. After these have been removed, examine the coin path for presence of foreign material or loose objects (such as chewing gum, small metallic objects, paper wads, etc.). In cases where game usage is heavy, it may be necessary to clean the entire coin path periodically, in order to prevent build-up of contaminants that can hinder the movement of coins through the mechanisms. Also confirm that the trip wire on each coin switch is intact, and is properly adjusted. If troubles still persist, check the conditions and positions of the lock-out wires, and the mechanical adjustments on the coin mechanisms, before suspecting the electronics. If a coin mechanism rejects genuine coins, try to readjust it. If this is not successful, then replace it with a working mechanism.

C. Fuse Replacement

Starship I contains four fuses, two on the power supply assembly and two on the TV monitor assembly. These fuses are all easily accessible through the rear access door. Replace fuses only with the same type of fuse as follows:

- **TV Monitor Fuses**: 3AG 1-amp slow-blow, 250 volts
- **Power Supply Fuses**: 3AG 2-amp slow-blow, 250 volts
REPLACING THE BLACK LIGHT TUBE

Remove the Front Housing Assembly as follows:

1. With a 7/16-inch wrench, reach through the coin door and remove four 4-20 hex nuts, one at each corner of the Control Panel Assembly.

2. Disconnect the harness connector from the Control Panel Assembly, then remove the Control Panel Assembly.

3. With a 0.125-inch hex wrench, remove three #10-32 x 1-inch buttonhead screws and the metal seam cover from the top of the Front Housing Assembly.

4. Lift off the Front Housing Assembly.

5. With a Phillips-head screwdriver, remove two #6 x 1.5-inch wood screws from each side of the Display Light Assembly.

6. Pull Display Light Assembly out of cabinet far enough to remove the black light.

7. Re-assemble the cabinet, performing steps 1 through 6 in the reverse order.

REPLACING THE FLUORESCENT TUBE

1. Remove the Display Plex Graphics Panel by using a 0.125-inch hex wrench to unscrew five #10-32 x 1-inch socket head screws.

2. Remove the fluorescent tube.

Figure 12 Removing the Cabinet Light Assembly
D. LAMP REPLACEMENT

Starship 1 contains five lamps: two cabinet lights, two PROTON TORPEDOS pushbutton lights, and a coin-door light. Cabinet lighting is done with an eighteen-inch fluorescent tube and on the back bezel with an eighteen-inch black light tube. Both the fluorescent and black light tubes are mounted in one lamp assembly. To remove the lamp assembly, follow the instructions in Figure 12.

There are two lamps (Chicago Miniature type #328) in the PROTON TORPEDOS pushbutton. These may be changed by reaching through the coin door. However, if you have had a bad day, you might consider removing the Control Panel Assembly first. This will eliminate the aggravation of working with these tiny bulbs in a tight space. Figure 13 shows how to replace these lamps.

E. REMOVING THE CONTROL PANEL

Removing the Control Panel Assembly can easily be accomplished through the coin door. Reach in with a 7/16-inch wrench and remove the four 1/8 x 20-inch hex nuts, split-lock washers and flat washers at each corner of the Control Panel Assembly. Remove the Control Panel Assembly.

F. CONTROL YOKE

The control yoke has two potentiometers. These potentiometers supply player steering information to the game PCB. With a good amount of use, these potentiometers may eventually become dirty and require cleaning. To clean, use a tuner cleaner. This is a spray cleaner that is available at most electronics supplies stores. When you buy tuner cleaner, make sure that you get the long nozzle extension tube that comes with the spray can.

For cleaning the potentiometers, remove the Control Panel Assembly (see Figure 12). Insert the spray nozzle extension tube into each potentiometer, spray, then work the control yoke to make the potentiometers rotate.

G. ADJUSTING THE CRASH CIRCLE

When Starship 1 crashes into another spacecraft or into a planet, an explosion occurs and a crash scene appears on the TV monitor. The crash scene is a circle of negative video. This circle is derived from a complex analog signal which is size-, shape- and position-adjustable.

![Figure 13 Removing the PROTON TORPEDOS Pushbutton Lamps](image-url)
To adjust the circle, set all four toggles of DIP switch S2 at location B8 to the on position. This will result in the display of all or part of a circle. Refer to Figure 14 for the location of the Circle Generator potentiometers V RAMP AMPLITUDE, H POS, V POS, and DC OFFSET. Adjust potentiometers H POS (horizontal position) and V POS (vertical position) to center the circle. Adjust potentiometer V RAMP AMPLITUDE for a round circle. Then adjust potentiometer DC OFFSET for a circle with a diameter that is about 2/3 the horizontal width of the TV monitor.

After you have adjusted the circle, set all four toggles of SW2 at location B8 to the off position. This concludes the adjustment.

II. REMOVING THE TV MONITOR

The TV monitor in Starship 1 may easily be replaced. This is accomplished by opening the rear access door, unplugging the Molex connector from the monitor, removing four securing screws, and sliding the monitor out the back door. See Figure 15 for the location of the securing screws on the monitor.
Step 1  Remove Screw.
Step 2  Remove wood screws.
Step 3  Reach through coin door and remove two securing nuts (and screws) from front of TV shelf assembly.
Step 4  Unplug Molex connector from TV monitor chassis.
Step 5  Lift back of TV shelf assembly and slide out of cabinet.

Figure 15  Removal of TV Monitor
A. GENERAL INFORMATION

The block diagram of Figure 16 shows the major controls, circuits and outputs of the game. Figure 17 is a block diagram of the Starship 1 game PCB.

The game's television monitor is a self-contained transistorized unit. Because the composite video signal sent to the monitor differs in many respects from the signal derived from commercial TV broadcasts, the picture appearing on the screen is unlike that of a home TV set and the monitor does not produce any sound. See Figure 18 for a schematic diagram of the TV monitor.

The game's composite video signal is made to produce only four video levels instead of the more or less continuous shades of grey seen on a home TV screen. The background of the picture is black video level only, but game objects may use any of the four video levels.
On the game PCB schematic diagram, Figure 20, the symbol "P" (appearing at various inputs of integrated circuit devices) indicates a connection of +5 volts DC through a pullup resistor. For easy reference, the game PCB is divided into grid sections. Along the short side of the board these sections are identified by letters A through R (skipping letters C, I, O and Q because they may be easily confused with the numbers 6, 10, and 0 respectively). Along the long side of the board the numbers 1 through 12 are used. For example, sheet 1 of Figure 20 illustrates the type MC1495 analog multiplier F1 at the lower left of the drawing. This device F1 will be found at coordinates F and 11 on the PCB.

Figure 19 is a harness schematic of the entire Starship 1 game. This figure illustrates how all electrical and electronic assemblies are electrically connected together.

B. POWER SUPPLIES (lower right corner of sheet 1, Figure 20)

The two AC voltage inputs to the board come from the 25 VAC and 16.5 VAC center-tapped secondary windings of the power transformer inside the Power Supply Assembly. The +5 volt regulated supply provides Vcc for most of the board's integrated circuits. The +12 volt and -12 volt regulated supplies provide lower-current voltages for analog circuitry on the game PCB. The unregulated +12 voltage connects to the audio driver stage for the game's audio output.

C. CRYSTAL OSCILLATOR AND TV SYNC COUNTDOWN CHAINS

A 12.096-MHz crystal oscillator (sheet 1 of Figure 20) generates the basic clock frequency that is divided down to produce the TV synchronization signals. The signals used to produce a TV raster consisting of 262 horizontal lines at a horizontal frequency of 15,750 Hz (256 Hz). Synchronized with line 240 is a vertical blanking pulse that occurs for the duration of 22 more horizontal scans, resulting in the total number of 262 lines per picture frame.

Besides being used for the TV raster, the TV timing signals are also used in the motion circuits, in the alphaneonics display circuit, in the phaser generator, in the microcomputer clock and in various other places on the board.

![Starship 1 Game Block Diagram](image-url)
D. MICROCOMPUTER

The microcomputer is the central controller for the action of the circuits that make up the game. The microprocessing unit (MPU) sends and receives data to and from the data bus. When the MPU is ready, it issues a start-low signal to the B and sets its address. It reads the address and data from the data bus. The MPU compares this data and does not address the RAM.

The program contains the MPU's zero offset memory to read and write to the zero offset memory. It also contains the MPU's program memory, which sets the program address of the programs that run on the MPU.

The microprocessor sends the MPU instructions to the data bus. The MPU reads the instructions and data from the bus. The MPU then processes the instructions and data. The MPU sends the results back to the data bus. The MPU reads the results and sends them back to the MPU.

The MPU can read and write to the data bus. It reads the instructions and data from the data bus. It processes the instructions and sends the results back to the data bus. It reads the results and sends them back to the MPU.

The MPU can read and write to the data bus. It reads the instructions and data from the data bus. It processes the instructions and sends the results back to the data bus. It reads the results and sends them back to the MPU.

E. INPUT/OUTPUT

Digital Output

The digital outputs of the MPU consist of decoder and data outputs. The decoder and data outputs are decoded to produce outputs of the MPU. The decoder outputs are decoded to produce outputs of the MPU. The decoder outputs are decoded to produce outputs of the MPU. The decoder outputs are decoded to produce outputs of the MPU.

Digital inputs or control signals, such as POWER, ON, and OFF, are decoded to produce outputs of the MPU. The decoder outputs are decoded to produce outputs of the MPU. The decoder outputs are decoded to produce outputs of the MPU. The decoder outputs are decoded to produce outputs of the MPU.

Decoders enable the MPU to control the data bus. The MPU sends data from the data bus to the data bus. The MPU reads data from the data bus and sends data to the data bus. The MPU reads data from the data bus and sends data to the data bus. The MPU reads data from the data bus and sends data to the data bus.

Address bits are also used to provide the MPU with the addresses in the MPU.

F. VIDEO SECTION

The video section consists of the circuits that generate images and the output area which generates the appropriate video signal. The video section receives data from the MPU and generates the appropriate video signal.

G. STARFIELD (CIRCUIT)

The starfield circuit is a two-dimensional register video generator (DRG) that produces the starfield and a "gloss" area in the plane.

H. SPACESHIP (CIRCUIT)

The spaceship circuit has a voltage-controlled oscillator (VCO) at its core, which produces a clock to
L. LASER CIRCUIT
   The laser circuit is fed by PHASE ON and produces the signal that makes the laser beam in the video.

J. ALPHANUMERIC GENERATOR
   Alphanumeric signals are fed to terminals N3 and N4. The signals are generated from the alphanumeric ROM, N7. The data is loaded into shift registers N7 and shifted over into the video.

I. CIRCLE GENERATOR
   The circle generator begins with a current source to bias Q1, Q2 and Q3 to produce the following ramps: AD, GDAMP, H.hlamp and V.hlamp. AD ramp is used in the scaling input matrix, but not in the circle. The H and V ramps are switched through the matrix. The ramps are multiplied into the N1 and N2. Then they are fed into and fed into comparator N1 which decides whether the video is being within the circle.

K. VIDEO PRIORITY CIRCUIT
   All video signals are fed to the KLM0 SUM which gives the appropriate priority to the video. Outputs switch through N1 to form the composite video containing sync, blanking, and all images.

M. AUDIO SECTION
   The three generators in the V.C. board C14 are used to produce the distinctive base sound. Audio is generated by the shift registers R6 and D3 and is fed to the AUDC602 voice board. The shift register drives switches for the "beep" of a system, the base sound, and the warning sound. The motor sound is made by a 2.5A at 140, and is level controlled by the signal ADCALS.

Variable tones are produced by the VCA and R40 and the DC at B16. Level control is provided by R45 and R32. All audio is summed at the volume control and goes to the TDA1068 audio amplifier and from there to the speakers.
Figure 15. TV Module Schematic.
Figure 20  Starship 1 PCB Schematic Diagram
(Sheet 2 of 3)