

Program Description I

Program Title STAR TREK-ADVANCED

Contributor's Name LARRY SCHNEIDER

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City WILKES-BARRE State PA. Zip Code 18701

Program Description, Equations, Variables COMPLETE INSTRUCTIONS

THE PROGRAMS: Program #1: Initialization and Long Range Tracking System;

This program starts the game off by generating random coordinates for the four alien vessels, and presetting the Enterprise coordinates, the fuel, the damage control, the sensor memory. In addition, this program controls the long range tracking system, a type of sensor probe used for vessels in deep space. Program #2: Course control and Sensor Probe; This program allows the captain to set the course of the ENTERPRISE and to operate the sensor system. Program #3: Battle Alert. This program does the necessary presetting prior to a battle with an alien vessel. Program #4: Shields and weapon fire; This program allows the user to set the ENTERPRISE shields, to fire its phaser banks, and to fire its photon torpedoes. In addition, it controls weapon fire upon the ENTERPRISE by an alien ship. Program #5: Post-firing operations; This program does the necessary presetting after a battle with an alien vessel. It includes ENTERPRISE self-destruct, a corbomite maneuver, and sensor repair operations. Program #6: Transport/Tractor beam/Docking; This program controls salvaging operations of the Nubian freighter and ENTERPRISE docking at Starbase.

HOW TO PLAY.....

~~Operating Instructions and Warnings~~ Welcome aboard the United Starship Enterprise. You are now the captain of this vessel and must make the decisions regarding the safety of the ship and of the crew. You fly the Enterprise on a triaxial coordinate system, each point corresponding to three coordinates, x, y, and z. This "galaxy" is represented in Fig. 1. You must never take the ship outside this area. Each axis is 100 units long in the positive direction so that you are playing in a cube with the following points as

its corners: 0,0,0; 0,99,0; 99,99,0; 99,0,0; 0,0,99; 0,99,99; 99,99,99.

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and 99,0,99.

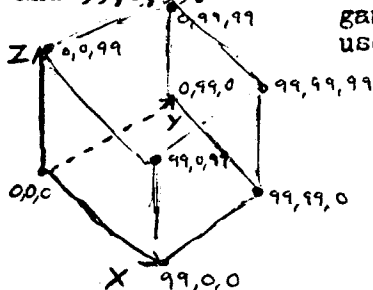


FIGURE 1

Your primary objective when playing Star Trek is to finish the game; that is, don't get blown up! No matter how much fuel you use, the ship, the crew, and you are no good to starfleet command blown "sky" high! Of secondary importance is your fuel. For the purposes of this game, fuel starts at 0 and increases. Hence, at the game's end, you will know how much fuel you have used up. Your goal each time you play Star Trek is to use the least amount of fuel possible. In this way, you can compare your play from one game to the next.

Aside from the Enterprise, there are four other vessels that play in this game (all represented by the calculator). Three of these are enemy vessels and they are (BEGINNING WITH THE STRONGEST): Klingon warship, Romulan warship,

Vallician warship. The fourth vessel is a friendly, stranded, Nubian freighter which you must salvage at one point or another during the game. The warships on the otherhand must be destroyed! The (x,y,z) coordinates of the Enterprise are always displayed in the following way: XX.OYYOZZ where XX, YY, and ZZ are the x,y, and z coordinates (from 00 to 99) and the O's are placeholders. The coordinates of the other ships are stored in their respective registers in a slightly different format: 1XX.1YY1ZZI where XX, YY, and ZZ are the x,y, and z coordinates, the 1's are placeholders, and I is the identification number of the vessel (Klingon=2, Romulan=3, Vallician=4, and Nubian=1). However, anytime these coordinates are displayed, they are done so in the same format shown for the Enterprise. In addition, the ID numbers for each alien vessel correspond to the secondary storage registers where their coordinates are stored.

PLAYING THE GAME.....

The 6 program cards for Star Trek are for the most part ordered in the sequence in which you will use them. After running card 1 through the reader (both sides), it should be placed in the slot above the user-defineable keys and left there for the game's entirety. The labels for this card are as follows: A--(Course) change; a--(Course) steady; B--Sensor probe; b--Weapons SB; C--Phasers; c--Dock; D--Photon Trpd's; ~~E--TTB/Prac.~~; e--Init. To begin the game, one must first input a random "seed" between 0 and 1 such as .1234567898 or .493768209. Try a practice game now. Input the seed .5514650293 (after reading card 1 of course). Now hit f E. The program is now presetting the secondary storage registers. In addition, it is also running through the Long Range Tracking System. LRTS is used as an aid in tracking down any one of the four ships randomly situated on the axes. Operating the LRTS uses up 250 units of fuel EXCEPT for the first time it is run which is now directly following initialization. You may use this system anytime during the game (it is operated directly by reading card 1 ~~and card 2~~). Note that the result 134 is blinking. ALL KEYSTROKES DURING STAR TREK ARE DONE DURING THE BLINKING PROCESS. In other words, a program should never stop running until the game is completely over. Even the magnetic cards are read during the blinks. Should you accidentally hit a key outside of the blink "window", the program will stop. Usually you can set things straight again by simply hitting R/S. This goes also if an entry you make should cause the display to say ERROR. Let's return now to our program which is now blinking 134 (Complete initialization takes from 45 to 60 seconds). 134 is called the mission sector and supplies us with information regarding the position of one alien vessel. Each digit of the mission sector corresponds to the range of the coordinate values, x,y, or z. For example, if the first digit of the mission sector was 1 (which it is), we would know that the x value of one of the alien ships is between 0 and 24 inclusive. 2 would correspond to a value between 25 and 49, 3, between 50 and 74, and 4, between 75 and 99. Thus in this example, one of the alien vessels has an x value from 0 to 24, a y value from 50 to 74 and a z value from 75 to 99. As a result of this information, we can now set a course for the Enterprise which is not totally derived from conjecture. We can set a course which would send us in the general direction of the mission sector. With luck, we'll come within range of another ship on the way, fight IT, and then still know in which direction to head for another alien contact. One word of advice regarding LRTS. Try not to overdo running this program unless you have absolutely no idea where to start looking for the enemy. 250 units of fuel can certainly go toward a better cause!

ENTERPRISE COURSE CONTROL.....

Now during one of the blinks of 134, read in both sides of card 2. Note that the program never stops running but goes directly onto the program on the new card. Now blinking in the display is the number 0.000000. This represents the Enterprise

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~~Program Description Equations Variables~~ coordinates which are now 0,0,0 (Starbase 0). Moving the Enterprise requires three inputs, the distance and two angles represented by ϕ and Θ . Once input here, a value will be retained in the display. For example, hit the following keys all during one blink: 3 ENTER 2 ENTER 1 ; 1.000000 is now in the x register (and display), 2 is in the y register, and 3 in the z register. The same can be accomplished is you hit 3, let it blink, hit 2, let it blink, and then hit 1. Note however if you hit 3, let it blink, 2 ENTER, let it blink, and 1 the registers (from T to X) will be 3,2,2, and 1. The point of all of this is to show you that inputting values for course change need not be hurried but they must be input correctly or else your values will not be positioned correctly in the stack (R(distance) in the z register, ϕ in the y register, and Θ in the x register and display.). A course change may be implemented at any time EXCEPT when you are under attack (i.e.; an ENEMY vessel is fewer than 35 units away from the Enterprise). Fuel drain for movement is calculated from 5 times the value of R (the distance moved) or 6 times R when the tractor beam is on (more about that later). The first input necessary as mentioned is the variable R. There is no limit to this input. An advantage of taking shorter jumps from one point ~~Operating Limits and Warnings~~ to another is that in conjunction with the sensor system, one might be able to more accurately determine the angular inputs that are best in directing the ship toward an enemy vessel. The second input is the azimuthal or horizontal angle, ϕ . This angle represents your direction on the horizontal plane; thus, it would correspond to the angle you would use on a two dimensional X,Y coordinate system (0 degrees to the right, 90 degrees forward, 180 degrees to the left, etc..).

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This angle must be within the range 0 to +180 and -1 to -179. The third input is the angle of elevation, θ , or the vertical angle and must be in the range -90 to +90. (-90 corresponds to going directly downward while +90 is upward). Note that if this is either +90, it makes no difference what the horizontal angle is. Should θ ever equal +90 degrees, use the convention of setting ϕ equal to 0 (this is important when firing weapons). Let's try a few operations for practice. To move five units to the right, we would hit 5 ENTER 0 ENTER 0 A (course change). The Enterprise coordinates are now 5,0,0. To move another 5 units to the right, one need only press f A (course steady). Do that now and see the new coordinates 10,0,0. Move 5 units straight up: 5 ENTER 0 ENTER 90 A...coordinates are now 10,0,5. Now 5 units forward: 5 ENTER 90 ENTER 0 A...The coordinates are now 10,5,5. By hitting 12 ENTER 153 CHS ENTER 24 CHS A, the Enterprise will return to Starbase 0 (0,0,0). The Enterprise coordinates will not change under the following conditions: 1) The Enterprise is under attack (an enemy vessel is less than 35 units away); if this is the case, Code 1 will be displayed, or 2) The new Enterprise coordinates would not lie in the range specified on the first page of instructions; if this is the case, the user WILL be charged for the fuel that would normally have been needed! The Sensor Probe program on card 2 is used to determine distances to alien vessels. Once the distance separating the Enterprise and an alien vessel is less than 40, the identification of the vessel will be revealed (unless sensors have been damaged--more about that later). At a distance ≤ 35 units, the Enterprise is considered to be under attack and cannot move. Starfleet orders clearly state that the Enterprise must stay and fight the enemy ship until the last possible moment. With the display blinking 0.000000, hit B to operate Sensor Probe. The number that comes up is -81.351091. This represents the distance in units to the ship closest to the Enterprise but more than 40 units away. It is the last output from sensor probe and is recognized by the negative sign. The display then returns to the Enterprise coordinates 0,0,0. Given the mission sector 134, hit the following keys to set the course for the Enterprise: 23 ENTER 60 ENTER 70 A. The new coordinates are 3,6,21. Move another 23 units in the same direction by hitting f A...the new Enterprise coordinates are 6,12,42. Now hit B again for another Sensor Probe. The first number displayed is 338.340579. An alien vessel is fewer than 40 units away (this is a positive number). To be precise, its distance is 38.340579 units. The first digit is the vessel's I.D. number. In this case, 3 represents the Romulan warship. Note the Enterprise is not yet under attack by the Romulans. The next output (and the last since it is negative) is -71.561163 is again the distance of the closest vessel more than 40 units away. Finally we see the Enterprise coordinates again, 6,12,42/ When the Enterprise is fighting an enemy vessel, a number of variables are used to determine the status of both ships. One very important value is the distance separating the two ships. It is probably best to be as far away from the enemy as possible when fighting it (i.e.; closer to 35) since the closer you are, the harder is the Enterprise hit by enemy fire. Then again, also keep in mind the enemy since Klingon fire is more dangerous than Vallician fire. Let us move in 5 more units by hitting 5 ENTER 60 ENTER 70 A...coordinates: 6,13,46. Now hit B, Sensor Probe. The first χ value is 334.539832 (Romulan warship firing upon the Enterprise and at a distance of 34+ units), the second and last (negative sign!) is -67+ (no need to explain), and then code 1 is shown (Note: Codes are recognized easily because they are always displayed in scientific notation...the only number important is the one to the left...the exponent is not relevant). Code 1 tells us that the Enterprise deflectors have automatically turned on due to the attack of the enemy Romulan. Note that a course change can no longer be made (try inputting values and hitting A!). As captain you must immediately signal BATTLE ALERT. Do this by reading card 3. The new number displayed is 0.0030. This lets us know what ships are attacking us. In this example, the Romulan is the only one. Input now the vessel you wish to fight (first). If you input a number of a vessel not in range, code 4 will be displayed (see CODES and EXPLANATIONS). Our only choice now is the Romulan, #3 so input 3 now. The program will continue by itself. The first thing displayed is CODE 3 (this will only be displayed if we are fighting a Romulan). The Romulan cloak is being used. What does this mean? When you fire your weapons at the enemy later on, you will need to input ϕ and θ as your guesses of the angles to the enemy. Your deviation from the actual angles is a factor in how well you've hurt the enemy ship. The Romulan cloak varies these actual angles by up to 9 degrees in either direction. The cloak drains energy from the Romulan ship so that the more ~~the more~~ the angles are varied, the easier the Romulan fire is on the Enterprise. So keep in mind the angles you'll be estimating aren't necessarily the correct ones in this case!

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~~Program Description, Equations, Variables~~ The last output from Battle Alert is the distance (rounded to a whole number)...We see here that the distance is 34.0000. Now read in card 4, shields and weapon fire. The distance is still displayed. The very first input now should be the initial setting for the shields. The shields value must not exceed 99. When selecting a shields value, consider the enemy ship, the distance, and the difference of the Enterprise and Enemy ship status (to be explained soon). It's probably best to start off with a relatively high value and gradually drop it every so often if you find yourself doing better. The number you will be seeing when running this program tells you much information. It is formatted like so: DD . OS_e S_e OS_v S_v SS where DD is the distance to the enemy, S_eS_e is the Enterprise status, S_vS_v is the attacking vessel status, and SS is the value of the shields. Status of either ship is a value ranging from 0 (no damages) to 100 (vessel blown up). Your objective is to get the enemy status to 100 before the Enterprise status gets there in as few rounds of firing as possible. After the first setting of the shields, the Enterprise will be hit by enemy fire. After that, no change in status will occur following a resetting of the shields value. To set or change the shields value, simply input ~~operating status and weapons~~ the setting. After reading in card 4, hit 80...the program will continue by itself. Note the shields setting is confirmed as 80 (last two digits) and the new Enterprise status is 4. Actually this is a small change in status compared to the average enemy fire. The reason the change is so low is because the cloak is being heavily used, and the distance is the largest possible, 34. When firing weapons, two angles must be input, ϕ and θ . In this example, there are immediately two things going against you: 1) the fact that the cloak is on heavily

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and 22) θ is calculated from the exact distance and now you are only given the distance rounded off (which could vary the angle several degrees)...this is the error in the Enterprise sensor system...it generally doesn't cause any problem. Guessing angles is a tricky business and the hardest duty you have as Captain. Included in this game is a program on "target practice" (on card 5). Later, hints will be given on how to best estimate these two firing angles. There are two differences between phasers and photon torpedoes: 1) Photon torpedoes increase the enemy ~~xx~~ status twice as much as would have been if phasers were fired (note: phasers: change in status=5; photon's: change in status=10.....phasers: change in status=0; photon's: change in status=0) and 2) Fuel cost is 2 and $2/3$ greater. Why then not fire phasers twice instead of photon torpedoes once? Because each time you fire upon the enemy they fire back and the difference in enemy and Enterprise status is an important factor in determining the new Enterprise status. Knowing exactly when to use your photon torpedoes is a skill that must be developed. It wouldn't be too difficult for the average player to quickly destroy the Romulan under these conditions. Shown below are a poor player's inputs in order to demonstrate the workings of this program. Before firing weapons, ~~fB~~ must be hit. The Enterprise coordinates will then be displayed (three pauses) and will be recognized as a negative number. These will alternate with the Alien coordinates (positive). To fire, simply hit \emptyset ENTER \emptyset and then C for phasers or D for photon torpedoes. Once an angle is input, it will be held for an extra cycle of pauses so that you need not be hurried in inputting the second angle or the firing label (C or D). For your first shot, you are given approximately 45 seconds of coordinate pausing to input your angles and fire before the enemy fires back. Each successive shot reduces the timer by 10 seconds (until 5 seconds are reached at which point you are given 5 seconds for every shot thereafter). Here now are the inputs of that poor player: (the status display is presently 34.00400080)

Weapons SB ^{stand-by}	Angles	New shields setting	Display
fB	-15,80 C		34.00800080
fB	-17,80 C		34.01300080
fB	-15,82 C		34.01800080
		90	34.01800090
fB	-13,78 C		34.02200190
fB	-11,78 C		34.02700290
fB	-10,75 C		34.03200490
fB	-10,73 C		34.03700790
fB	-10,73 D		34.04201390
fB	-8, 73 C		34.04701690
fB	-8, 71 C		34.05202090
fB	-8, 69 C		34.05702590
fB	-8, 67 C		34.06203190
fB	-6, 67 C		34.06703990
fB	-6, 65 C	CODE 0 displayed	34.07000090 (34.07100090)
The sensors have been damaged...you must now continue without knowledge of the enemy's status.			
fB	-6,65 C	CODE 0 displayed	34.07500090
fB	-6, 65 D	Enemy destroyed	-5. Actual \emptyset
			64. Actual \emptyset
			0.

This ends with the blinking zero. Normally the last blinking digit would be the I.D.# of the alien vessel destroyed. The 0 is blinking because the sensors have been damaged. Eventually one might receive a code 5. This means the shields have been knocked out. You can either try ONE more shot to destroy the enemy (if you don't you're a dead duck!) or go immediately to card 5 for the corbomite maneuver (tricking the enemy into retreating...however, you will meet him again before the game's end). If you go to card 5 before receiving code 5, the Enterprise will self-destruct. To summarize, go on to card 5 immediately following the destruction of the enemy (blinking I.D.), after receiving code 5 and wishing to play it safe, or before receiving code 5 and wishing to blow up the Enterprise yourself. No doubt the first couple of times you fight an enemy vessel, you'll probably be blown up. It takes experience...and lots of practice to be a captain of a starship.

Back to the game. Since we have destroyed the enemy (if you haven't already done the

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~~Program Description I~~ series of keystrokes above, do so now), we can now read in card 5. The program will continue automatically and determine what to do 1) generate new coordinates for the enemy (it has retreated) 2) self-destruct or 3) none of the above--the enemy has been destroyed. In cases 1 and 3, the last output will be the Enterprise coordinates signalling you to continue on to your next mission. In this example, presetting is done quickly and the Enterprise coordinates appear in the display: 6,13,46. There are two more things to discuss. Return now to card #2 and read it in. Now hit 75, ENTER 52 ENTER 17 A for a course change...new Enterprise coordinates: 50,69,67. Now hit B, Sensor Probe. The first output is 18.055470. It is positive...but why isn't the vessel I.D. present? Because our sensors were damaged in the last battle. How does one repair the sensors? There are two ways 1) By docking at starbase (to be explained later) or 2) By destroying an enemy vessel in battle and keeping the Enterprise status under 51. In this case, repairs will be done in the program on card 5. Repairs are signalled by code 6. Back to the output 18+. Since this value is under 35, we are probably under attack (if this was the case, which it isn't, we wouldn't receive a choice of combat when we ran Battle Alert). The ~~Operating Limits and Warnings~~ second output is -41+ (no need to explain). The third output is CODE -1. So we are not under attack. We are receiving communications from a stranded Nubian freighter (which is 18+ units away) (if sensors were operating, the first output would have been 118+). The fourth output is CODE 0 (reminding us that sensors are damaged). Finally the coordinates again. If a Nubian is fewer than 35 units away, the Enterprise is still capable of being moved. If both a Nubian and an enemy vessel are within range, the Nubian gets priority and must be

These figures were calculated to get the Enterprise to a specific location for reasons of Nubian salvaging explanation.

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salvaged before going into battle with the enemy vessel. When the Nubian appears in the sensor probe, it does not have to be salvaged immediately; If you wish, you can pick it up later. Remember that towing it costs extra fuel in both movement and also when operating the shields in battle. However, it might not be convenient to go out of the way to pick it up later. The choice is yours. UNDER NORMAL CONDITIONS (SENSORS NOT DAMAGED) THE COORDINATES OF THE NUBIAN FREIGHTER WOULD BE DISPLAYED WHEN RUNNING SENSOR PROBE IF THE NUBIAN WERE FEWER THAN 35 UNITS AWAY...THE NUBIAN COORDINATE FORMAT WOULD BE 1.XXYZZZ...IT WOULD BE DISPLAYED WITH SCIENTIFIC NOTATION. With sensors damaged, you must salvage without knowing the coordinates. Salvaging the Nubian involves beaming (transporting) the occupants aboard the Enterprise and towing the vessel with the Enterprise tractor beam. All of this can only be done when the Nubian is fewer than 10 units away. Once this is accomplished salvaging can be accomplished. Input now: ~~10~~ 52 ENTER 52 ENTER 17 A. The new Enterprise coordinates are 55, 76, 69. Check the distance to the Nubian. Hit B. The distance is now 9.48+. Close enough for salvaging operations. Once coordinates of the Enterprise are returned to the display, read in card 6. Press E. Negative Enterprise coordinates signify completion of salvaging operations and tractor beam on. Docking at Starbase is similar. The Enterprise must be fewer than 10 units away from coordinates 0,0,0. In addition, no alien vessels must be in the vicinity. If there are, code 8 will appear and you should go immediately to card 2 and run the Sensor Probe program. Such an alien vessel must be destroyed before the starbase shields are lowered. Once you are within range, go to card 6 and hit f C. The Enterprise coordinates will become 0,0,0. The Nubian will be released and out of tow. Repairs will be completed on sensors. (Note that the latter two events will occur only under the right conditions...Nubian being towed for the former, sensors damaged for the latter.). The Enterprise coordinates 0,0,0 will be displayed if you must go out again. If the three enemy vessels have all been destroyed and the Nubian freighter salvaged, code 9 will appear and the fuel will be displayed. The game is over!

TARGET PRACTICE PROGRAM--CARD 5

The two angles used in firing weapons are derived from two right angle triangles. Figure 2 shows the representation of ϕ . The side opposite to the angle is the difference in y values (enemy y value minus Enterprise y value) while the adjacent side is the difference in x values. Figure 3 shows how θ is formed in a triangle whose side opposite to the angle is the difference in z values and whose hypotenuse is the distance. The Star Trek beginner can use triangles such as these to help him estimate the firing angles. He may also choose to memorize some key ratios and corresponding angles as shown in Figure 4.

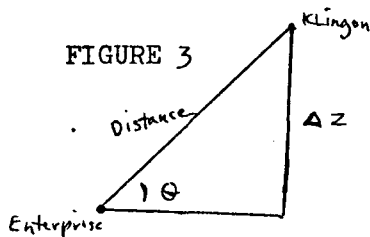
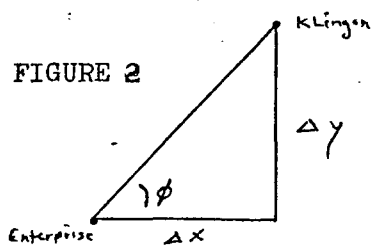


FIGURE 4
absolute value
of $\Delta Y/\Delta X$

0	
1/2	1/4=14*
1	3/4=37*
3/2	5/4=51*
2	7/4=60*
3	
4	
6	
10	
20	

ϕ
0
26.5*
45
56*
63.5*
71.5*
76*
80.5*
84*
87*

absolute value
of $\Delta Z/D$

0
1/8
1/4
3/8
1/2
5/8
3/4
7/8
33/34 ^o

θ
0
7*
14.5*
22*
30
39*
48.5*
61*
76*

*approximation ^olargest possible angle

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~~Program Description I, Equations, Variables~~ Read card 5 in now. * Input a seed between 0 and 1 (say, .1234566789). Hit E. The first number output will be the distance between the Enterprise and the alien; in our example, it is 20.22+. The next output will be the Enterprise coordinates (negative sign). For purposes of target practice, the Enterprise coordinates will always be 50.050050 or 50,50,50. These will blink three times. The next output are the coordinates of the alien vessel; in our example, 59.048032 or 59,48,32. These, too, will blink three times. Finally, the distance is displayed again. These last three inputs will keep repeating until two angular inputs are made separated by an ENTER. Figures 5 and 6 show the triangles that would be used for these angles.

* FIRST, TURN HP-67/97 OFF, THEN ON.

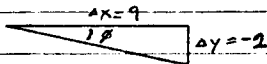
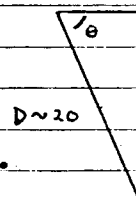


FIGURE 5 $|Y/X| = .222...$



$\Delta Z = -18$

FIGURE 6

$|Z/D| = .900$

The angles made be input during any blink.

Keep in mind that when playing Star Trek,

you see the exact distance in Sensor Probe and the "rounded-off" distance during weapon fire. Let's input as our guesses the numbers -10

~~Operating times and warnings~~ and -60 (10 CHS ENTER 60 CHS). The next output from the program will be the correct horizontal angle (-12.5+). Following this will be the correct vertical angle (-62.8+) and finally --how far off we were--(5.4+). A new problem is then generated and you can try again!

--SHIELDS AND WEAPON FIRE FUEL COST AND STATUS CHANGE--

The fuel needed for the shields is equal to twice the value set for

~~the shields (three times the value if you are towing the Nubian freighter).~~

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Hence, if the shields setting is 75, the fuel cost is 150 (225 if the Nubian is being towed...The Enterprise must provide extra shields protection for this ship). Phasers require 3 times the distance in fuel units while Photon Torpedoes require 8 times the distance (rounded off). Shields and firing fuel drain is calculated each time the weapons are fired.

Here are the formulae used for calculating change in enemy and Enterprise status:

$$\Delta S_e = \text{INT} \left\{ \frac{(6-I)(10000)(S_e - S_v + 100)^2}{(D)(10 \times S)^2} \right\}$$

$$\Delta S_v = \text{INT} \left\{ \frac{((0.1 - 0.03^* \text{LN}(A)))(S_v - S_e + 100)^2 (W)}{D} \right\}$$

WHERE:

* To make the game more challenging, this number can be changed to $-0.04(\text{LN}(A))$. See program step # 111 on card # 4.

ΔS_e = the CHANGE in Enterprise Status

ΔS_v = the CHANGE in Attacking Vessel Status

I = the I.D.# of the attacking Vessel (2 for the Klingon, 3, 4, or 5 for the Romulan*, and 4 for the Vallician)

S_e = ENTERPRISE STATUS

S_v = ATTACKING VESSEL STATUS

D = Distance (rounded to a whole number)

S = The shields setting

LN = Natural log

A = the SUM of the ABSOLUTE VALUES of the DIFFERENCES of the two guessed angles and the two correct angles
 $(|\phi_{\text{guess}} - \phi_{\text{correct}}| + |\theta_{\text{guess}} - \theta_{\text{correct}}|)$

W = 1 for Phasers and 2 for Photon Torpedoes

*The more the Romulan cloak is used, the higher is the value of the I.D.# and the lower is the change of Enterprise Status for any set of values.

A rare occurrence: Should the positions of the enemy and the Enterprise happen to be such that the two firing angles can be deduced exactly (for example Enterprise=15,15,15; Enemy= 15,45,15; $\phi = 90$, $\theta = 0$), you should input one angle with an added error (for example, input 0.001 instead of 0.000) since two correct inputs would cause an error display when the calculator tries to compute LN(A) (See S_v formula above).

Should you know the vertical angle to be 90 degrees, inputting 0 and 90 as the angles would cause an error display. Rather input 0.001 and 90 or 0.000 and 90.001.*

*Recall that if $\theta = 90$ degrees, the calculator sets ϕ equal to 0.

Sketch(es)

CODES AND EXPLANATIONS

All codes are displayed in scientific notation.
The number to the left is relevant...the exponent to the right is not.

~~XXXXXXXXXXXX~~
Sample Problem(s)CODE #EXPLANATION

0	Sensor system damaged from enemy phaser attack.
1	Deflectors on--Enterprise under attack.
-1	Enterprise receiving communication from Nubian freighter. It is stranded and requires assistance.
2	Docking at Starbase 0 completed.
3	Romulan warship employing the cloaking device.
4	Alien vessel out of range.
5	Enterprise shields knocked out.
6	Sensor system repairs completed
7	Enterprise out of range (for TTB, docking, etc...)
8	Alien vessel in the area. Starbase 0 will not lower their shields to allow the Enterprise to dock.
9	GAME OVER

~~XXXXXXXXXX~~
Solution(s)

-9	Enterprise on SELF-DESTRUCT (3 second countdown).
9.999999999 99	Enterprise destroyed by enemy vessel.

Reference(s)

User Instructions

CARD # 2

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1 COURSE--
f-steady
-change sensors 2

[illegible]

User Instructions

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CARD # 3

BATTLE ALERT

1

2

[illegible]

User Instructions

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CARD # 4

SHIELDS / WEAPON FIRE

f WEAPONS

PHASERS PHOTON T.

updated
10/11/27

[illegible]

BOST-FIRING OPERATIONS/PRACTICE

CARD # 5

1

2

Practice

[illegible]

CARD # 6

TTB

[illegible]

Program Listing I

Program 1

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STEP	KEY ENTRY	KEY CODE
001	GT0d	22 16 14
002	*LBL2	21 16 15
003	CLRG	16-53
004	ST00	35 00
005	4	04
006	ST01	35 46
007	1	01
008	ST07	35 07
009	*LBL0	21 00
010	6	06
011	ST06	35 06
012	ST0A	35 11
013	RCLI	36 46
014	1	01
015	X=Y?	16-33
016	SF0	16 21 00
017	*LBL1	21 01
018	GSB9	23 09
019	EEX	-23
020	2	02
021	X	-35
022	INT	16 34
023	ST0B	35 12
024	F0?	16 23 00
025	GSB5	23 05
026	RCLB	36 12
027	EEX	-23
028	2	02
029	+	-55
030	RCL6	36 06
031	10*	16 33
032	=	-24
033	ST+i	35-55 45
034	3	03
035	ST-6	35-45 06
036	RCL6	36 06
037	0	00
038	X=Y?	16-35
039	GT01	22 01
040	RCLI	36 46
041	F0?	16 23 00
042	ST+9	35-55 09
043	EEX	-23
044	7	07
045	=	-24
046	ST+i	35-55 45
047	DSZ1	16 25 46
048	GT00	22 00
049	2	02
050	5	05
051	0	00
052	CHS	-22
053	ST06	35 06
054	PzS	16-51
055	CLRG	16-53
056	*LBLd	21 16 14

COMMENTS

If program is running, Go to L.R.T.S.
Initialize.

Store Seed

Set damages off

Nubian coordinates?
Set flag to store in R₃₉

Nubian?
Yes - Add to R₃₉

random
coordinate

Position coordinate

New coordinate
Add ID of ship

New ship
set Fuel = -250 so
that 1st legs run
costs no fuel.

Long Range Tracking System
(L.R.T.S.)

STEP	KEY ENTRY	KEY CODE
057	PzS	16-51
058	*LBL2	21 02
059	GSB9	23 09
060	4	04
061	X	-35
062	1	01
063	+	-55
064	INT	16 34
065	ST01	35 46
066	RCLi	36 45
067	EEX	-23
068	3	03
069	X=Y?	16-33
070	GT02	22 02
071	R↓	-31
072	X<0?	16-45
073	GT02	22 02
074	ST0A	35 11
075	CLX	-51
076	ST0B	35 12
077	3	03
078	ST01	35 46
079	*LBL3	21 03
080	RCLA	36 11
081	INT	16 34
082	EEX	-23
083	2	02
084	-	-45
085	2	02
086	5	05
087	=	-24
088	1	01
089	+	-55
090	INT	16 34
091	RCLI	36 46
092	1	01
093	-	-45
094	10*	16 33
095	X	-35
096	RCLB	36 12
097	+	-55
098	ST0B	35 12
099	RCLA	36 11
100	FRC	16 44
101	EEX	-23
102	3	03
103	X	-35
104	ST0A	35 11
105	DSZ1	16 25 46
106	GT03	22 03
107	2	02
108	5	05
109	0	00
110	ST+6	35-55 06
111	RCLB	36 12
112	PzS	16-51

COMMENTS

Random #

Random ship

Already destroyed?
New random ship

Towed Nubian?
New random ship.

Position in Mission Sector

Add 250 to Fuel.
Mission Sector

REGISTERS

0	1	2	3	4	5	6	7	8	9
S0 Seed	S1 Nubian	S2 Klingon	S3 Romulan	S4 Vulcanian	S5 Enterprise	S6 counter/ Fuel	S7 Damages EFFEL IREQ	S8 ships in vicinity	S9 Nubian
A Counter for Register S ₉ Positioning	B used / Mission Sector	C	D	E	I Counter				

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COMMENTS

160

0	Nubian Coordinates		TRIG		DISP	
1	ON	OFF	DEG	<input checked="" type="checkbox"/>	FIX	<input checked="" type="checkbox"/>
2	1	<input type="checkbox"/>	GRAD	<input type="checkbox"/>	SCI	<input type="checkbox"/>
3	2	<input type="checkbox"/>	RAD	<input type="checkbox"/>	ENG	<input type="checkbox"/>
	3	<input type="checkbox"/>			n	<u>0</u>

Program Listing I - Program 2

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00369D

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	*LBL1	21 01		057	INT	16 34	
002	FIX	-11		058	P+S	-16-51	
003	P+S	16-51		059	ST+6	35-55 06	
004	RCL1	36 01		060	RCL5	36 05	
005	ENT↑	-21		061	P+S	-16-51	
006	ABS	16 31		062	R↓	-31	
007	=	-24		063	*LBL0	21 00	
008	RCL5	36 05	Nubian towed? If yes	064	R↑	16-31	
009	P+S	-16-51	(R<0) Make Enterprise negative.	065	ENT↑	-21	
010	X	-35		066	FRC	16 44	
011	*LBL0	21 00		067	EEX	-23	
012	PSE	16 51		068	3	03	
013	GT00	22 00		069	X	-35	
014	*LBLA	21 11		070	X*Y	-41	
015	ST06	35 06		071	INT	16 34	
016	R↓	-31		072	RCLi	36 45	
017	STOC	-35 13		073	+	-55	
018	X*Y	-41		074	INT	16 34	
019	ST04	35 04		075	X<0?	16-45	New coordinate
020	RCL6	36 06		076	GT01	22 01	
021	SIN	41		077	EEX	-23	
022	RCL4	36 04		078	2	02	
023	X	-35		079	X<Y?	16-35	
024	ST01	35 01		080	GT01	22 01	
025	RCL6	36 06		081	X*Y	-41	
026	COS	42		082	RCL6	36 06	
027	RCL4	36 04		083	10*	16 33	
028	X	-35		084	=	-24	
029	ST06	35 06		085	ST+7	35-55 07	
030	RCLC	36 13		086	3	03	
031	SIN	41		087	ST+6	35-55 06	
032	RCL6	36 06		088	DSZI	16 25 46	
033	X	-35		089	GT00	22 00	
034	ST02	35 02		090	RCL7	36 07	New Enterprise coordinates
035	RCLC	36 13		091	P+S	16-51	
036	COS	42		092	ST05	35 05	
037	RCL6	36 06		093	P+S	16-51	
038	X	-35		094	GT01	22 01	
039	ST03	35 03		095	*LBLB	21 12	Sensor Probe
040	*LBLA	21 16 11		096	CLX	-51	
041	GSB7	23 07		097	P+S	16-51	
042	3	03		098	ST08	35 08	
043	ST01	35 46		099	RCL0	36 00	
044	P+S	16-51		100	Pi	16-24	
045	RCL1	36 01		101	+	-55	
046	P+S	16-51		102	5	05	
047	0	00		103	Y*	31	
048	ST06	35 06		104	FRC	16 44	
049	ST07	35 07		105	ST00	35 00	
050	X*Y?	16-34		106	RCL7	36 07	Damage Register
051	1	01		107	P+S	16-51	
052	ENT↑	-21		108	SCI	-12	
053	5	05		109	X=0?	16-43	Damaged?
054	+	-55		110	PSE	16 51	Display code 0
055	RCL4	36 04		111	FIX	-11	
056	X	-35		112	EEX	-23	

REGISTERS

0 I.D.	1 ΔZ	2 ΔY	3 ΔX	4 R	5	6 (Distance θ / R cos θ Positioning Center)	7 (EC-Ca) New Enterprise Coordinates	8	9
S0 Seed	S1 Nubian	S2 Klingon	S3 Romulan	S4 Vallian	S5 Enterprise	S6 Fuel	S7 Damages wcc, ocp = 1	S8 ships in Vicinity	S9 Nubian
A	B Used for counter	C φ	D I.D. Nubian Coordinates	E	I Counter				

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
113	3	03		169	XZY?	16-35	
114	ST08	35 08		170	GT06	22 06	Close enough for Battle
115	R↑	16-31		171	RCL0	36 00	No
116	4	04	Random #	172	ENT↑	-21	Ship I.D.
117	x	-35		173	10*	16 33	
118	X	01		174	÷	-24	
119	+	-55		175	PzS	16-51	Add to "ships in vicinity"
120	INT	16 34		176	ST+8	35-55 08	register
121	ST00	35 00		177	PzS	16-51	
122	ST08	35 12		178	*LBL6	21 06	
123	*LBL2	21 02		179	GSBe	23 16 15	print distance within w/o I.D.
124	RCL0	36 00		180	*LBL5	21 05	
125	ST01	35 46		181	ISZ↑	16 26 45	Increment Register 0
126	PzS	16-51		182	5	05	
127	RCL↑	36 45	Alien coordinates 1XX.1YY.1ZZ	183	RCL0	36 00	
128	RCL5	36 05	Enterprise " XX.0YY.0ZZ	184	X=Y?	16-33	R ₀ =5?
129	PzS	16-51		185	1	01	Yes - Set it to 1.
130	-	-45		186	ST00	35 00	
131	3	03		187	RCL8	36 12	Value marking end of loop.
132	ST01	35 46		188	X≠Y?	16-32	
133	CLX	-51		189	GT02	22 02	
134	ST07	35 07		190	RCL8	36 00	Smallest D ≥ 40
135	R↓	-31		191	CHS	-22	
136	*LBL3	21 03		192	PRTX	-14	
137	ENT↑	-21		193	GSB7	23 07	check for ships in vicinity
138	INT	16 34		194	GT01	22 01	
139	EEX	-23		195	*LBL7	21 07	
140	2	02	C = x, y, or z	196	PzS	16-51	
141	-	-45		197	RCL8	36 00	ships in vicinity
142	X ²	53	C - C ₀	198	PzS	16-51	
143	ST+7	35-55 07	(C - C ₀) ²	199	X=0?	16-43	No ships around
144	R↓	-31		200	RTN	24	Return
145	FRC	16 44		201	.	-62	
146	EEX	-23		202	1	01	
147	3	03		203	SCI	-12	
148	x	-35		204	XZY?	16-35	Nubian in vicinity?
149	DSZ↑	16 25 46		205	CHS	-22	Yes - DSP code -1
150	GT03	22 03		206	PRTX	-14	No - DSP code 1
151	ST00	35 14	I.D.	207	X>0?	16-44	Nubian in vicinity?
152	RCL7	36 07	$(x-x_0)^2 + (y-y_0)^2 + (z-z_0)^2$	208	GT01	22 01	No - Return
153	JX	54	Distance	209	PzS	16-51	Yes - Show Nubian
154	ST06	35 06		210	RCL9	36 09	coordinates
155	4	04		211	PzS	16-51	Nubian coordinates
156	0	00		212	ST00	35 14	
157	X>Y?	16-34		213	CLX	-51	
158	GT04	22 04		214	ST06	35 06	
159	CLX	-51		215	*LBL6	21 16 15	Print Nubian coordinates or
160	RCL8	36 08		216	PzS	16-51	code
161	X>Y?	16-34		217	RCL7	36 07	0.
162	X≠Y	-41		218	PzS	16-51	
163	ST08	35 08	Smallest D ≥ 40	219	X≠0?	16-42	Sensors on?
164	GT05	22 05		220	RCLD	36 14	I.D./Nubian Coordinates
165	*LBL4	21 04		221	RCL6	36 06	Distance / 0
166	CLX	-51		222	+	-55	
167	3	03		223	PRTX	-14	
168	5	05		224	RTN	24	

LABELS

FLAGS

SET STATUS

A COURSE CHANGE	B Sensor Probe	C	D	E	0	FLAGS	TRIG	DISP
a COURSE STEADY	b	c	d	e	1	ON OFF	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>
0 ✓	1 ✓	2 ✓	3 ✓	4 ✓	2	1 <input type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
5 ✓	6 ✓	7 ✓	8 ✓	9 ✓	3	2 <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						3 <input type="checkbox"/>		n. 6

REGISTERS									
0 I.D.	1 Variable I.D. AZ	2 AY	3 AX	4	5 Alien coordinates	6 ϕ	7 Θ	8 Distance	9
S0 Seed	S1 Nubian	S2 Klingon	S3 Romulan	S4 Vullician	S5 Enterprise	S6 Fuel	S7 Damages? off=1; on=0	S8 ships in vicinity	S9 Nubian
A		B		C		D		E	
								I Counter	

Program Listing II - Program 3

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STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
113	RCL0	36 00	If sensors damaged, Don't display code 3. $\Delta \phi$ $\Delta \theta$	169	FIX	-11	A ship in vicinity? Yes ... continue No
114	ST01	35 01		170	RCL8	36 00	
115	3	03		171	P2S	16-51	
116	X#Y?	16-32		172	*LBL8	21 00	
117	GT04	22 04		173	FRC	16 44	
118	SCI	-12	Total angular change due to cloaking device Determine change in I.D. to lessen brunt of Romulan Attack.	174	1	01	No ships - code "4"
119	F0?	16 23 00		175	0	00	
120	PRTX	-14		176	X	-35	
121	FIX	-11		177	ENT↑	-21	
122	GSB5	23 05		178	INT	16 34	
123	ST+6	35-55 06	Distance $\Delta \phi$ or $\Delta \theta$	179	X#0?	16-42	
124	ABS	16 31		180	GT07	22 07	
125	GSB5	23 05		181	R↓	-31	
126	ST+7	35-55 07		182	DSZ1	16 25 46	
127	ABS	16 31		183	GT08	22 00	
128	+	-55	Sensors damaged.	184	SCI	-12	
129	.	-62		185	4	04	
130	1	01		186	GT06	22 06	
131	5	05		187	R/S	51	
132	X	-35					
133	.	-62	Display code 0 Determine <u>first</u> ship in vicinity				
134	2	02					
135	1	01					
136	-	-45					
137	INT	16 34					
138	ST+1	35-55 01					
139	*LBL4	21 04					
140	RCL8	36 00					
141	*LBL6	21 06					
142	PSE	16 51					
143	GT06	22 06					
144	*LBL5	21 05					
145	P2S	16-51					
146	RCL0	36 00					
147	Pi	16-24					
148	+	-55					
149	5	05					
150	Y*	31					
151	FRC	16 44					
152	ST00	35 00					
153	P2S	16-51					
154	2	02					
155	0	00					
156	X	-35					
157	1	01					
158	0	00					
159	-	-45					
160	INT	16 34					
161	RTN	24					
162	*LBL9	21 09					
163	CF0	16 22 00					
164	SCI	-12					
165	4	04					
166	ST01	35 46					
167	CLX	-51					
168	PRTX	-14					

LABELS					FLAGS	SET STATUS		
A	B	C	D	E	0 Sensors damaged?	FLAGS	TRIG	DISP
a	b	c	d	e	1	ON OFF	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>
0	1	2	3	4	2	0 <input checked="" type="checkbox"/> <input type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
5	6	7	8	9	3	1 <input type="checkbox"/> <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
					Input Flag	2 <input type="checkbox"/> <input type="checkbox"/>		n <u>4</u>
						3 <input type="checkbox"/> <input checked="" type="checkbox"/>		

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	EEX	-23		057	-	-45	
002	2	02		058	X#0?	16-42	
003	STOE	35 15		059	STO2	35 02	
004	CLX	-51		060	RCL2	36 02	
005	STOA	35 11		061	STOI	35 46	
006	STO3	35 03		062	*LBL2	21 02	
007	STO4	35 04		063	PZS	16-51	
008	1	01		064	RCL5	36 05	
009	2	02		065	PZS	16-51	
010	STO2	35 02		066	CHS	-22	
011	*LBL0	-21 00		067	GSB3	23 03	Enterprise Coordinates
012	CF1	16 22 01		068	RCL5	36 05	
013	RCL8	-36 08		069	GSB3	23 03	Alien Coordinates
014	RCL3	-36 03	Distance	070	GT02	22 02	
015	EEX	-23	SE	071	*LBL1	21 01	
016	3	03		072	RCL5	36 15	Reset shields
017	=	-24		073	X#Y?	16-35	New value must be less than 100.
018	+	-55		074	GT00	22 00	
019	PZS	16-51	DD.OSESE	075	X#Y	-41	
020	RCL7	-36 07		076	STOA	35 11	
021	PZS	16-51	Damages?	077	F2?	16 23 02	
022	STO9	35 09		078	GT04	22 04	First time around?
023	SCI	-12		079	RCL3	36 03	Yes - Alien Fire
024	X=0?	16-43		080	RCL3	36 03	
025	PRTX	-14	Sensors damaged?	081	SCI	-12	
026	RCL4	-36 04	Yes - Display code 0	082	GT05	22 05	
027	X	-35	Sv	083	*LBLD	21 14	
028	EEX	-23	= Sv if no damages	084	SF1	16 21 01	PHOTON TORPEDOS
029	6	06	= 0 if damages	085	*LBLC	21 13	PHASERS
030	=	-24		086	RCL7	36 07	
031	+	-55		087	-	-45	
032	RCLA	36 11	DD.OSESE OSvSv	088	ABS	16 31	
033	EEX	-23	SHIELDS	089	X#Y	-41	
034	8	08		090	RCL6	36 06	
035	=	-24		091	-	-45	
036	+	-55		092	ABS	16 31	
037	FIX	-11	DD.OSESE OSvSvSS	093	+	-55	
038	DSP8	-63 08		094	STOB	35 12	
039	*LBL5	21 16 15		095	0	00	
040	4	04		096	F1?	16 23 01	
041	F0?	16 23 00	Battle not begun or over?	097	5	05	
042	10*	16 33	Yes - blink status	098	ENT†	-21	
043	STOI	35 46	"forever" - if in middle of battle, blink status 4 times only.	099	3	03	
044	R4	-31		100	+	-55	
045	*LBL9	21 09		101	RCL8	36 08	
046	CF3	16 22 03		102	X	-35	
047	PSE	16 51		103	PZS	16-51	
048	F3?	16 23 03		104	ST+6	35-55 06	
049	GT01	22 01	Shield value input?	105	PZS	16-51	
050	DSZ1	16 25 46	Yes - reset	106	2	02	
051	GT09	22 09		107	RCLB	36 12	
052	*LBL6	21 16 12		108	LN	32	
053	CF0	16 22 00	Weapon stand-by	109	.	-62	
054	DSP6	-63 06		110	0	00	
055	RCL2	36 02	Decrement firing time counter	111	3	03	
056	2	02		112	CHS	-22	

REGISTERS

0 ID	1 ID	2 FIRING TIME COUNTER	3 SE	4 Sv	5 Alien Coordinates	6 Ø	7 Ø	8 Distance	9 Damages?
S0 Seed	S1 Nubian	S2 Klingon	S3 Romulan	S4 Valtician	S5 Enterprise	S6 Fuel	S7 Damages? 765=0	S8 SHIPS IN VICINITY	S9 Nubian
A Shields	B AØ + AØ	C	D	E	F 100	G Counter			

STPD	KEY ENTRY	KEY CODE	COMMENTS	STPD	KEY ENTRY	KEY CODE	COMMENTS
113	X	-35		169	RCL4	36 04	
114	S	-62	$-.03 \ln(A)$	170	GSB8	23 08	$(6-I)(10^4)(S_E-S_V+100)^2$
115	1	01		171	RCLA	36 11	
116	+	-55		172	1	01	D
117	RCL4	36 04	$0.1 - 0.03 \ln(A)$	173	0	00	
118	RCL3	36 03	S_V	174	X	-35	10 K Shields
119	GSB8	23 08	S_E	175	X2	53	$(10 \times S)^2$
120	F1?	16 23 01	$[.1 - .03 \ln(A)] [S_V - S_E + 100]^2$	176	=	-24	
121	X	-35	D	177	INT	16 34	$(6-I)(10^4)(S_E-S_V+100)^2$
122	X<0?	16-45	times 2 if PHOTON TRP's	178	ST+3	35-55 03	$(D)(10 \times S)^2$
123	GT04	22 04		179	RCL3	36 03	
124	INT	16 34		180	RCL5	36 15	S_E
125	ST+4	35-55 04		181	X<Y?	16-35	$S_E \geq 100?$
126	RCL4	36 04		182	N!	16 52	Yes - ENT, DESTROYED
127	RCL5	36 15		183	CLX	-51	
128	X>Y?	16-34		184	7	07	
129	GT04	22 04		185	0	00	
130	1	01		186	X>Y?	16-34	
131	CHS	-22	Destruction of	187	GT05	22 05	$S_E > 70$
132	STX5	35-35 05	ALien	188	CLX	-51	
133	DSP0	-63 00		189	P2S	16-51	Yes - Sensors
134	RCL6	36 06		190	ST07	35 07	damaged - $R_{S7} = 0$
135	PSE	16 51		191	P2S	16-51	
136	RCL7	36 07		192	*LBL5	21 05	
137	PSE	16 51		193	CLX	-51	
138	RCL0	36 00		194	8	08	
139	RCL9	36 09		195	5	05	
140	X	-35	Don't display ID is	196	X>Y?	16-34	$S_E > 85$
141	SF0	16 21 00	damages incurred: $R_p = 0$	197	GT00	22 00	
142	GT0e	22 16 15		198	CLX	-51	
143	*LBL4	21 04		199	ST0A	35 11	Yes - shields out
144	SCI	-12	ALien Fire	200	5	05	
145	P2S	16-51		201	ENT1	-21	
146	RCL1	36 01	Nubian towed?	202	PRTX	-14	
147	0	00		203	GT00	22 00	
148	X>Y?	16-34		204	*LBL3	21 03	
149	1	01	Yes: Fuel = 3 x Shields	205	PSE	16 51	
150	ENT1	-21		206	PSE	16 51	
151	2	02	No: Fuel = 2 x Shields	207	PSE	16 51	
152	+	-55		208	DSZ1	16 25 46	
153	RCLA	36 11	Shields	209	GT07	22 07	
154	X	-35	Fuel	210	GT04	22 04	
155	ST+6	35-55 06		211	*LBL7	21 07	
156	P2S	16-51		212	F3?	16 23 03	
157	6	06		213	GT03	22 03	
158	RCL1	36 01	ID (I)	214	RTN	24	
159	-	-45	6-I	215	*LBL8	21 08	
160	EEX	-23		216	-	-45	
161	4	04		217	RCL5	36 15	
162	X	-35	$(6-I)(10^4)$	218	+	-55	
163	RCL3	36 03		219	X2	53	
164	8	08		220	X	-35	
165	5	05		221	RCL8	36 08	
166	X<Y?	16-35	ENTERPRISE DESTROYED	222	=	-24	
167	N!	16 52	IF SHIELDS OUT	223	RTN	24	
168	CLX	-51		224	R/S	51	

LABELS					FLAGS	SET STATUS		
A	B	C PHASERS	D PHOTON TORPEDOS	E	0 ON IF BATTLE not begun or over	FLAGS	TRIG	DISP
a	b WEAPON STAND-BY	c	d	e	1 ON IF PHOTON TRP'D's	ON OFF	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>
0	1	2	3	4	2 ALien Fire FIRST TIME	1 <input type="checkbox"/> <input checked="" type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
5	6	7	8	9	3 INPUT CHECK	2 <input checked="" type="checkbox"/> <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						3 <input type="checkbox"/> <input checked="" type="checkbox"/>		n <u>8</u>

Program Listing I - Program 5

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STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	SCI	-12		057	=	-24	
002	RCL5	36 05		058	ST+5	35-55 05	
003	X<0?	16-45	Alien coordinates	059	RCL5	36 05	
004	GT00	22 00	Less than 0 (destroyed)?	060	P+S	16-51	
005	3	03	Yes... continue	061	ST01	35 45	Replace old Alien coordinates with new.
006	ST01	35 46	No... check for Retreat	062	P+S	16-51	
007	0	00		063	CF0	16 22 00	Flag off - Alien NOT destroy
008	ST05	35 05		064	7	07	
009	RCL3	36 03	SE	065	ENT↑	-21	
010	8	08		066	PRTX	-14	Display code 7
011	5	05		067	GT04	22 04	
012	X<Y?	16-35	Illegal retreat (SE < 85)?	068	*LBL0	21 00	Check for Sensor Repairs
013	GT01	22 01	No... continue	069	P+S	16-51	
014	DSP0	-63 00	Yes... self-destruct	070	RCL7	36 07	
015	CHS	-22		071	P+S	16-51	
016	ENT↑	-21		072	X<0?	16-42	No damages?
017	PRTX	-14	Display code -9	073	GT04	22 04	None... continue
018	FIX	-11		074	RCL3	36 03	SE
019	*LBL2	21 02		075	5	05	
020	RCL1	36 46		076	1	01	
021	PSE	16 51	Count down.	077	X<Y?	16-35	SE > 50
022	DSZI	16 25 46		078	GT04	22 04	Yes... No Repairs.
023	GT02	22 02		079	P+S	16-51	No... Repairs
024	EEX	-23		080	1	01	
025	2	02		081	ST07	35 07	
026	N!	-16 52	Enterprise destroyed.	082	P+S	16-51	
027	*LBL1	21 01	Legal retreat... New Alien coordinates.	083	6	06	
028	P+S	16-51		084	ENT↑	-21	
029	RCL0	36 00		085	PRTX	-14	Display code 6
030	Pi	16-24		086	*LBL4	21 04	
031	+	-55		087	FIX	-11	
032	5	05		088	RCL0	36 00	I.D.
033	Y*	31		089	CLRG	16-53	
034	FRC	16 44		090	P+S	16-51	
035	ST00	35 00		091	ST01	35 46	
036	P+S	16-51		092	EEX	-23	
037	EEX	-23		093	3	03	
038	2	02		094	F0?	16 23 00	Alien destroyed?
039	X	-35		095	ST01	35 45	Yes - STORE 1000.
040	LSTX	16-63		096	RCL1	36 01	
041	+	-55		097	ENT↑	-21	
042	INT	16 34	coordinate	098	ABS	16 31	
043	RCL1	36 46		099	=	-24	
044	1	01		100	RCL5	36 05	
045	-	-45		101	X	-35	
046	3	03		102	P+S	16-51	
047	X	-35		103	*LBL5	21 05	
048	10*	16 33		104	PSE	16 51	
049	÷	-24		105	GT05	22 05	
050	ST+5	35-55 05		106	*LBLE	21 15	Practice
051	DSZI	16 25 46		107	CF3	16 22 03	
052	GT01	22 01		108	CLRG	16-53	
053	RCL0	36 00		109	ST00	35 00	
054	ST01	35 46		110	5	05	
055	EEX	-23		111	0	00	
056	7	07		112	.	-62	

REGISTERS

0 I.D./Seed	1 ΔX(x-S0)	2 x	3 ΔY(y-S0)	4 Y	5 (New) Alien Counter (ZS0)	6 Z	7 φ	8 θ	9 Practice Alien coordinate
S0 Seed	S1 Nubian	S2 Klingon	S3 Romulan	S4 Vallician	S5 Enterprise	S6 Fuel	S7 Damages CPE = 1.0N=0	S8 ships in vicinity	S9 Nubian
A -50.050050	B Distance	C	D	E	I Counter				

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Program Listing II - Program 5

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STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
113	0	00		169	*LBL6	21 06	
114	5	05		170	RCLi	36 45	
115	0	00		171	RCLi	36 46	
116	0	00		172	1	01	
117	5	05		173	.	-62	
118	CHS	-22		174	5	05	
119	STOA	35 11	Enterprise coordinates	175	x	-35	
120	*LBL9	21 09		176	3	03	
121	6	06		177	-	-45	
122	STOI	35 46		178	10*	16 33	
123	*LBL3	21 03		179	=	-24	
124	RCL0	36 00		180	+	-55	
125	Pi	16-24		181	DSZI	16 25 46	
126	+	-55		182	DSZI	16 25 46	
127	5	05		183	GT06	22 06	
128	Y*	31		184	ST09	35 09	Alien coordinates
129	FRC	16 44		185	*LBL7	21 07	
130	ST00	35 00		186	RCLA	36 11	Enterprise
131	4	04		187	PSE	16 51	
132	1	01		188	PSE	16 51	
133	x	-35		189	PSE	16 51	
134	3	03		190	F3?	16 23 03	Angle input?
135	0	00		191	GT08	22 08	yes
136	+	-55		192	RCL9	36 09	Alien
137	INT	16 34		193	PSE	16 51	
138	STOI	35 45		194	PSE	16 51	
139	DSZI	16 25 46		195	PSE	16 51	
140	5	05		196	F3?	16 23 03	Angle input?
141	0	00		197	GT08	22 08	
142	-	-45		198	RCLB	36 12	Distance
143	STOI	35 45		199	PSE	16 51	
144	DSZI	16 25 46		200	F3?	16 23 03	
145	GT03	22 03		201	GT08	22 08	
146	RCL3	36 03		202	GT07	22 07	
147	RCL1	36 01	Δy	203	*LBL8	21 08	
148	→P	34	Δx	204	X*Y	-41	ϕ_{guess}
149	R↓	-31		205	RCL7	36 07	ϕ_{actual}
150	ST07	35 07		206	PRTX	-14	
151	RCL5	36 05	ϕ	207	-	-45	
152	RCL5	36 05	Δz	208	ABS	16 31	
153	X²	53		209	X*Y	-41	θ_{guess}
154	RCL3	36 03	Δy	210	RCL8	36 08	θ_{actual}
155	X²	53		211	PRTX	-14	
156	RCL1	36 01	Δx	212	-	-45	
157	X²	53		213	ABS	16 31	
158	+	-55		214	+	-55	
159	+	-55		215	PRTX	-14	
160	JX	54	Distance	216	GT09	22 09	
161	STOB	35 12		217	R/S	51	
162	PRTX	-14					
163	=	-24					
164	SIN⁻¹	16 41					
165	STOB	35 08					
166	6	06					
167	STOI	35 46					
168	0	00					

LABELS					FLAGS	SET STATUS		
A	B	C	D	E Practice	0 Alien Destruction	FLAGS	TRIG	DISP
a	b	c	d	e	1	ON OFF		
0 ✓	1 ✓	2 ✓	3 ✓	4 ✓	2	0 <input checked="" type="checkbox"/> <input type="checkbox"/>	DEG <input checked="" type="checkbox"/>	FIX <input checked="" type="checkbox"/>
						1 <input type="checkbox"/> <input type="checkbox"/>	GRAD <input type="checkbox"/>	SCI <input type="checkbox"/>
5 ✓	6 ✓	7 ✓	8 ✓	9 ✓	3	2 <input type="checkbox"/> <input type="checkbox"/>	RAD <input type="checkbox"/>	ENG <input type="checkbox"/>
						3 <input type="checkbox"/> <input type="checkbox"/>		n <u>6</u>

STEP	KEY ENTRY	KEY CODE	COMMENTS	STEP	KEY ENTRY	KEY CODE	COMMENTS
001	001 *LBL0	21 00		057	DSZ?	16 25 45	
002	002 FIX	-11		058	1	01	
003	003 P2S	16-51		059	RCL0	36 00	
004	004 RCL1	36 01		060	X#Y?	16-32	
005	005 ENT?	-21		061	GT04	22 04	
006	006 ABS	16 31		062	P2S	16-51	ALL Aliens out of range
007	007	-24		063	EEX	-23	
008	008 RCL5	36 05		064	3	03	
009	009 P2S	16-51		065	RCL1	36 01	
010	010 X X	-35		066	X#0?	16-45	Nubian Towed?
011	011 *LBL1	21 01		067	R4	-31	Yes - STORE 1000.
012	012 PSE	16 51		068	ST01	35 01	
013	013 GT01	22 01		069	2	02	
014	014 *LBL0	21 15	TTC (Transport/Tractorbay)	070	ENT?	-21	
015	015 P2S	16-51		071	PRTX	-14	Display code 2
016	016 RCL1	36 01		072	0	00	
017	017 GSB2	23 02	Check distance to Nubian	073	ST05	35 05	Enterprise Coordinates = 900
018	018 GSB5	23 05	D < 10?	074	4	04	
019	019 P2S	16-51	Yes	075	ST01	35 46	
020	020 RCL1	36 01		076	RCL7	36 07	
021	021 CHS	-22		077	X#0?	16-42	Damages?
022	022 ST01	35 01		078	GT07	22 07	No... continue.
023	023	-62		079	1	01	
024	024 1	01		080	ST07	35 07	Repair
025	025 ST-8	35-45 08	Cancel from ship in vicinity	081	6	06	
026	026 P2S	16-51		082	ENT?	-21	
027	027 GT00	22 00		083	PRTX	-14	Display code 6
028	028 *LBL0	21 16 13	Docking and Repairs.	084	*LBL7	21 07	
029	029 P2S	16-51		085	RCL1	36 45	check for game over.
030	030 1	01		086	EE	-23	
031	031 0	00		087	3	03	
032	032 0	00		088	X#Y?	16-32	game over?
033	033	-62		089	GT08	22 08	No... continue.
034	034 1	01		090	DSZ?	16 25 46	
035	035 0	00		091	GT07	22 07	
036	036 0	00		092	DSP0	-63 00	Yes.
037	037 1	01		093	9	09	
038	038 GSB2	23 02	check distance to Starbase.	094	ENT?	-21	
039	039 GSB5	23 05	D < 10?	095	PRTX	-14	Display code 9
040	040 4	04	Yes	096	FIX	-11	
041	041 ST00	35 00		097	RCL6	36 06	FUEL
042	042 *LBL4	21 04	check for other aliens	098	R/S	51	END
043	043 RCL0	36 00	around starbase.	099	*LBL8	21 08	
044	044 ST01	35 46		100	P2S	16-51	
045	045 P2S	16-51		101	GT00	22 00	
046	046 RCL1	36 45		102	*LBL2	21 02	Distance
047	047 GSB2	23 02	check distance to Alien.	103	RCL5	36 05	
048	048 4	04		104	=	-45	
049	049 0	00		105	P2S	16-51	
050	050 X#Y?	16-35	out of range?	106	3	03	
051	051 GT06	22 06	Yes... continue.	107	ST01	35 46	
052	052 8	08		108	CLX	-51	
053	053 ENT?	-21		109	ST07	35 07	
054	054 PRTX	-14		110	R4	-31	
055	055 GT00	22 00		111	*LBL3	21 03	
056	056 *LBL6	21 06		112	ENT?	-21	

REGISTERS

0	1	2	3	4	5	6	7 Distance	8	9
S0 Seed	S1 Nubian	S2 Klingon	S3 Remulan	S4 Vulcanian	S5 Enterprise	S6 Fuel	S7 Damages? on 20; off = 1	S8 ships in vicinity	S9 Nubian
A	B	C	D	E	I	Counter			

[illegible]

00369D

10/11/77

Dear HP user,

Listed below are some minor improvements and corrections to ADVANCED STAR TREK. They have been compiled from the letters and Program Comments I have received from various users.

1) This is neither a correction or an enhancement. It is an oversight made by many users which has prompted many of the invalid coding errors that some users claimed were included in the program. Basically, inconsistencies and errors may crop up if you do not preset the flags before storing your STAR TREK programs. I have reviewed these below...

Program 1--None (set display to FIX 0) (None implies all flags OFF)

Program 2--None (set display to FIX 6)

Program 3--The version most users have includes no flag presetting.

I have added some improvements to this program which necessitates Flag 0 to be preset ON. This is mentioned below. (set display to FIX 4)

Program 4--SET FLAG 2...If this is not done, the sample battle in the instructions will not correspond to the figures that show up on your display (i.e. the first status display comes up as 34.00000080 when it should be 34.00400080. Flag 2 controls initial alien fire upon the ENTERPRISE). (set display to FIX 8)

Program 5--SET FLAG 0...With this flag preset, the program assumes that it is dealing with a destroyed alien before it even begins. If it finds out that the alien is not destroyed, it clears the flag at line 63. (set display to FIX 6)

Program 6--None (set display to FIX 6)

--I assume that everyone knows what I mean by PRESETTING the flags and display before recording the program on a card.--

2) A minor addition. Between steps 31 ($h \leftrightarrow y$) and 32 (STO 0) of Program 3, one might want to add the steps...

1	01	
$h \leftrightarrow y$	35 52	For further additions to
$g \leq 0$	32 71	Program 3, see below.
GTO 0	22 00	

...to ensure that the player's input is not less than or equal to 1.

3) An oversight on my part...When I write $g \text{ DSZ } 32 \text{ } 33$, I really mean $g \text{ DSZ}(i) \text{ } 32 \text{ } 33$...For an example, see program 6, line 57.

4) ENHANCEMENTS TO PROGRAM 3.

These additions are so few, that I did not deem it necessary to rewrite the entire program listing.

Replace step 87 ($f \text{ INT}$) with

DSP 0	23 00
f RND	31 24
DSP 4	23 04

Distance between Enterprise and attacking vessel will now be properly rounded (e.g. 34.4+ will round to 34 and 34.6+ will round to 35).

Between step 112 ($g \text{ SCI}$) and 113 ($f \text{ -x-}$), add step $h \text{ F? } 0 \quad 35 \text{ } 71 \text{ } 00$