## **Orbit**

ORBIT challenges you to visualize spatial positions in polar coordinates. The object is to detonate a Photon explosive within a certain distance of a germ laden Romulan spaceship. This ship is orbiting a planet at a constant altitude and orbital rate (degrees/hour). The location of the ship is hidden by a device that renders the ship invisible, but after each bomb you are told how close to the enemy ship your bomb exploded. The challenge is to hit an invisible moving target with a limited number of shots.

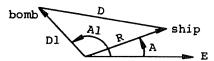
The planet can be replaced by a point at its center (called the origin); then the ship's position can be given as a distance from the origin and an angle between its position and the eastern edge of the planet.



The distance of the bomb from the ship is computed using the law of cosines (see line 430 of the program listing). The law of cosines states

$$D = \sqrt{R^{**}2 + D1^{**}2 + R^{*}D1^{*}COS (A-A1)}$$

where D is the distance between the ship and the bomb, R is the altitude of the ship, D1 is the altitude of the bomb, and A-A1 is the angle between the ship and the bomb.



## **Practice Off-Line Problem:**

Aircraft appear on radar as blips of the form "=". What is the distance between the TWA and United aircraft shown on the radar screen on the right. ORBIT CREATIVE COMPUTING MORRISTOWN, NEW JERSEY

SOMEWHERE ABOVE YOUR PLANET IS A ROMULAN SHIP.

THE SHIP IS IN A CONSTANT POLAR ORBIT. ITS DISTANCE FROM THE CENTER OF YOUR PLANET IS FROM 10,000 TO 30,000 HILES AND AT ITS PRESENT VELOCITY CAN CIRCLE YOUR PLANET ONCE EVERY 12 TO 36 HOURS.

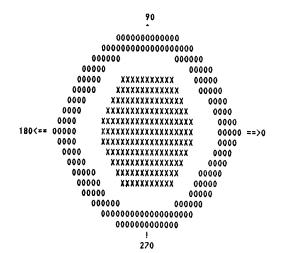
UNFORTUNATELY THEY ARE USING A CLOAKING DEVICE SO YOU ARE UNABLE TO SEE THEM, BUT WITH A SPECIAL INSTRUMENT YOU CAN TELL HOW MEAR THEIR SHIP YOUR PHOTON BOMB EXPLODED. YOU HAVE SEVEN HOURS UNTIL THEY HAVE BUILT UP SUFFICIENT POWER IN ORDER TO ESCAPE YOUR PLANET'S GRAVITY.

YOUR PLANET HAS ENOUGH POWER TO FIRE ONE BOHB AN HOUR.

AT THE BEGINNING OF EACH HOUR YOU WILL BE ASKED TO GIVE AN ANGLE (BETWEEN 0 AND 360) AND A DISTANCE IN UNITS OF 100 MILES (BETWEEN 100 AND 300), AFTER WHICH YOUR BOMB'S DISTANCE FROM THE ENEMY SHIP WILL BE GIVEN.

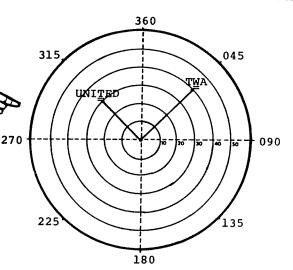
AN EXPLOSION WITHIN 5,000 HILES OF THE ROMULAN SHIP

BELOW IS A DIAGRAM TO HELP YOU VISUALIZE YOUR PLIGHT.



X - YOUR PLANET

0 - THE ORBIT OF THE ROMULAN SHIP



ORBIT was originally called SPACE WAR and was written by Jeff Lederer of Project SOLO Pittsburgh, Pennsylvania.

ON THE ABOVE DIAGRAM, THE ROHULAN SHIP IS CIRCLING COUNTERCLOCKWISE AROUND YOUR PLANET. DON'T FORGET WITHOUT SUFFICIENT POWER THE ROHULAN SHIP'S ALTITUDE AND ORBITAL RATE WILL REMAIN CONSTANT.

GOOD LUCK. THE FEDERATION IS COUNTING ON YOU.

HOUR 1 , AT WHAT ANGLE DO YOU WISH TO SEND YOUR PHOTON BOMB? 90 HOW FAR OUT DO YOU WISH TO DETONATE IT? 250

YOUR PHOTON BOND EXPLODED 270.671 \*10^2 MILES FROM THE ROMULAN SHIP.

HOUR 2 , AT WHAT ANGLE DO YOU WISH TO SEND YOUR PHOTON BOND? 260 HOW FAR OUT DO YOU WISH TO DETONATE IT? 200

YOUR PHOTON BONB EXPLODED 382.522 \*10°2 MILES FROM THE ROMBI AN SHIP.

HOUR 3 , AT WHAT ANGLE DO YOU WISH TO SEND YOUR PHOTON BOMB? 35 HOW FAR OUT DO YOU WISH TO DETONATE IT? 200

YOUR PHOTON BOMB EXPLODED 136.808 \*10^2 MILES FROM THE ROMULAN SHIP.

HOUR 4 , AT WHAT ANGLE DO YOU WISH TO SEND YOUR PHOTON BOMB? 20 HOW FAR OUT DO YOU WISH TO DETONATE IT? 300

YOUR PHOTON BOMB EXPLODED 342.719 \*10^2 HILES FROM THE ROMULAN SHIP.

HOUR 5 , AT WHAT ANGLE DO YOU WISH TO SEND YOUR PHOTON BOMB? 40 HOW FAR OUT DO YOU WISH TO DETONATE IT? 100

YOUR PHOTON BOND EXPLODED 228.24 \*10^2 MILES FROM THE ROMULAN SHIP.

HOUR 6 , AT WHAT ANGLE DO YOU WISH TO SEND YOUR PHOTON BONB? 55 HOW FAR OUT DO YOU WISH TO DETONATE IT? 209

YOUR PHOTON BOMB EXPLODED 328.821 \*10^2 MILES FROM THE ROMULAN SHIP.

HOUR 7 , AT WHAT ANGLE DO YOU WISH TO SEND YOUR PHOTON BOMB? 20 HOW FAR OUT DO YOU WISH TO DETONATE IT? 100

YOUR PHOTON BOMB EXPLODED 299.178 #10^2 MILES FROM THE ROMULAN SHIP.
YOU HAVE ALLOWED THE ROMULANS TO ESCAPE.
ANOTHER ROMULAN SHIP HAS GONE INTO ORBIT.
DO YOU WISH TO TRY TO DESTROY IT? I HATE COMPUTERS THAT NEVER LOSE GOOD BYE.

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2 PRINT TAB(33); "ORBIT"
4 PRINT TAB(15); "CREATIVE COMPUTING MORRISTOWN, NEW JERSEY"
5 PRINT: PRINT: PRINT
10 PRINT "SOMEWHERE ADOVE YOUR PLANET IS A ROMULAN SHIP."
15 PRINT
20 PRINT "THE SHIP IS IN A CONSTANT POLAR ORBIT. ITS"
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25 PRINT "DISTANCE FROM THE CENTER OF YOUR PLANET IS FROM"

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30 PRINT "10,000 TO 30,000 HILES AND AT ITS PRESENT VELOCITY CAN"
 31 PRINT "CIRCLE YOUR PLANET ONCE EVERY 12 TO 36 HOURS."
 35 PRINT
40 PRINT "UNFORTUNATELY THEY ARE USING A CLOAKING DEVICE SO"
45 PRINT "YOU ARE UNABLE TO SEE THEN, BUT WITH A SPECIAL"
50 PRINT "INSTRUMENT YOU CAN TELL HOW NEAR THEIR SHIP YOUR"
 55 PRINT "PHOTON BOMB EXPLODED. YOU HAVE SEVEN HOURS UNTIL THEY"
 60 PRINT "HAVE BUILT UP SUFFICIENT POWER IN ORDER TO ESCAPE"
 65 PRINT "YOUR PLANET'S GRAVITY."
 70 PRINT
 75 PRINT "YOUR PLANET HAS ENOUGH POWER TO FIRE ONE BOMB AN HOUR."
80 PRINT
85 PRINT "AT THE BEGINNING OF EACH HOUR YOU WILL BE ASKED TO GIVE AN" 90 PRINT "ANGLE (BETWEEN 0 AND 360) AND A DISTANCE IN UNITS OF"
95 PRINT "100 HILES (BETWEEN 100 AND 300), AFTER WHICH YOUR BONB'S"
100 PRINT "DISTANCE FROM THE ENEMY SHIP WILL BE GIVEN."
 105 PRINT
 110 PRINT "AN EXPLOSION WITHIN 5,000 HILES OF THE ROMULAN SHIP"
 111 PRINT "WILL DESTROY IT."
114 PRINT
 115 PRINT "BELOW IS A DIAGRAM TO HELP YOU VISUALIZE YOUR PLIGHT."
116 PRINT
 117 PRINT
168 PRINT "
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179 PRINT "180(== 00000
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186 PRINT "
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187 PRINT "
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188 PRINT "
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189 PRINT "
190 PRINT "
                                           270"
192 PRINT
195 PRINT "X - YOUR PLANET"
196 PRINT "O - THE ORBIT OF THE ROMULAN SHIP"
197 PRINT
198 PRINT "ON THE ABOVE DIAGRAM, THE ROMULAN SHIP IS CIRCLING"
199 PRINT "COUNTERCLOCKUISE AROUND YOUR PLANET. DON'T FORGET"
200 PRINT "WITHOUT SUFFICIENT POWER THE ROMULAN SHIP'S ALTITUDE"
210 PRINT "AND ORBITAL RATE WILL REMAIN CONSTANT."
220 PRINT
230 PRINT "GOOD LUCK. THE FEDERATION IS COUNTING ON YOU."
270 A=INT(360+RNB(1))
280 B=INT(200+RND(1)+200)
290 R=INT(20+RND(1)+10)
300 H=0
310 IF H=7 THEN 490
320 H=H+1
325 PRINT
326 PRINT
330 PRINT "HOUR";H;", AT WHAT ANGLE DO YOU WISH TO SEND"
335 PRINT "YOUR PHOTON BONB";
340 INPUT A1
350 PRINT "HOW FAR OUT DO YOU WISH TO DETONATE IT";
360 INPUT DI
365 PRINT
366 PRINT
370 A=A+R
380 IF A<360 THEN 400
390 A=A-360
400 T=ABS(A-A1)
410 IF T<180 THEN 430
420 T=360-T
430 C=SQR(D+D+D1+D1-2+D+D1+COS(T+3.14159/180))
440 PRINT "YOUR PHOTON BOMB EXPLODED";C;"*10^2 MILES FROM THE"
450 IF C<=50 THEN 470
460 60TO 310
470 PRINT "YOU HAVE SUCCESFULLY COMPLETED YOUR MISSION."
480 GOTO 500
490 PRINT "YOU HAVE ALLOWED THE ROMULANS TO ESCAPE."
500 PRINT "ANOTHER ROMULAN SHIP HAS GONE INTO ORBIT."
510 PRINT "DO YOU WISH TO TRY TO DESTROY IT";
520 INPUT CS
530 IF C$="YES" THEN 270
540 PRINT "GOOD BYE."
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999 END