

= Computer Space =

Computer Space is a space combat arcade game developed in 1971 as one of the last games created in the early history of video games . Created by Nolan Bushnell and Ted Dabney in partnership as Syzygy Engineering , it was the first arcade video game as well as the first commercially available video game . Computer Space is a derivative of the 1962 computer game Spacewar , possibly the first video game to spread to multiple computer installations . It features a rocket , controlled by the player , engaged in a missile battle with a pair of flying saucers set against a background starfield . The goal is to score more hits than the enemy spaceships within a set time period , which awards a free round of gameplay . The game is enclosed in a custom fiberglass cabinet in one of four colors , which Bushnell designed himself to be futuristic .

The game was designed by Bushnell and Dabney during 1970 ? 71 to be a coin @-@ operated version of Spacewar . After the pair were unable to find a way to economically run the game on a minicomputer such as the Data General Nova , they hit upon the idea of instead replacing the central computer with custom @-@ designed hardware created just to run that game . After they built an early proof of concept and founded Syzygy Engineering , Bushnell found a manufacturer for the game in Nutting Associates . Working in partnership with Nutting , the pair ran their first location test in August 1971 , one month prior to the display of a similar prototype called Galaxy Game , also based on Spacewar . After encouraging initial results , though mixed responses from distributors , Nutting ordered an initial production run of 1 @,@ 500 units with the anticipation of a hit game . While the game was successful and validated Syzygy 's belief in the future of arcade video games , selling over 1 @,@ 000 cabinets by mid @-@ 1972 and ultimately 1 @,@ 300 ? 1 @,@ 500 units , it was not the runaway success that Nutting had hoped for . The game spawned one clone game , Star Trek (1972) , and Nutting produced a two @-@ player version of Computer Space in 1973 without involvement from Syzygy before closing in 1976 . Syzygy went on to be incorporated as Atari , with their next arcade game the successful Pong (1972) . Although not as influential as Pong , Computer Space 's release marked the initial start of the commercial video game industry .

= = Background = =

At the beginning of the 1970s , video games existed almost entirely as novelties passed around by programmers and technicians with access to computers , primarily at research institutions and large companies . One of these games was Spacewar , created in 1962 for the Digital Equipment Corporation (DEC) PDP @-@ 1 minicomputer by Steve Russell and others in the programming community at the Massachusetts Institute of Technology . The two @-@ player game has the players engage in a dogfight between two spaceships , set against the backdrop of a starfield , with a central star exerting gravitational force upon the ships . The game was copied to several of the early minicomputer installations in American academic institutions after its initial release , making it potentially the first video game to be available outside a single research institute . Spacewar was extremely popular in the small programming community in the 1960s and was widely recreated on other minicomputer and mainframe computers of the time , later migrating to early microcomputer systems . Early computer scientist Alan Kay noted in 1972 that " the game of Spacewar blossoms spontaneously wherever there is a graphics display connected to a computer , " and contributor Martin Graetz recalled in 1981 that as the game initially spread it could be found on " just about any research computer that had a programmable CRT " . Although the game was widespread for the era , it was still very limited in its direct reach : the PDP @-@ 1 was priced at US \$ 120 @,@ 000 and only 55 were ever sold , most without a monitor , which prohibited the original Spacewar or any game of the time from reaching beyond a narrow , academic audience . The original developers of Spacewar considered ways to monetize the game , but saw no options given the high price of the computer it ran on . The first commercial video game based on Spacewar would not be released until Computer Space in 1971 .

= = Gameplay = =

In Computer Space , the player controls a rocket as it attempts to shoot a pair of flying saucers while avoiding enemy fire . The monochrome game has the three ships flying on a two @-@ dimensional plane , set against the backdrop of a starfield . Missiles are fired one at a time , and there is a cooldown period between launches . The player 's rocket follows Newtonian physics , remaining in motion even when the player is not accelerating , though the rocket can rotate at a constant rate without inertia . The flying saucers stay in place or glide in a zig @-@ zag pattern around the screen in tandem , with one staying a constant distance directly below the other . If a ship or missile moves past one edge of the screen , it reappears on the other side in a wraparound effect . While the missile is in flight , the player can turn it left or right instead of turning their rocket .

Player controls are clockwise and counterclockwise rotation , forward thrust , and firing missiles . Whenever the player is hit by a missile or flying saucer , the screen flashes and the player 's rocket spins rapidly and disappears , then reappears in the same location . If a flying saucer is hit by a missile , the screen flashes and the saucer briefly disappears . Counters on the right side of the screen keep count of the number of times the player 's rocket has been destroyed and the saucers have been destroyed , as well as how long that round of gameplay has lasted . A round has an adjustable time limit of 60 to 150 seconds , with a default of 90 ; when the time limit is reached , the game ends if the player 's score is lower than the computer 's . If it is higher , the black and white colors invert in a " hyperspace " feature , and another round begins for free ; the game continues on to new rounds with the display colors inverting indefinitely if the player continues to win . One round costs a quarter , or two quarters if the machine is adjusted against the instruction manual 's recommendations . The game displays distorted characters if the player or computer scores pass 9 , and scores restart at 0 if they reach 16 .

In the two @-@ player version of the game , a second game mode is added featuring two player @-@ controlled rockets fighting each other instead of computer @-@ controlled ships . The modified control panel contains two sets of controls , with joysticks replacing the movement buttons on some machines .

= = Development = =

In the late 1960s , Nolan Bushnell saw Spacewar running on a mainframe at the University of Utah where he was a student . Bushnell worked during the summer at Lagoon Amusement Park in Utah as a manager of the games department overseeing the arcade games , and when he saw Spacewar he believed that an arcade game version of the game would be very popular . The high price of computers capable of running the game , however , meant that any such arcade game would not be economically feasible . After graduating from college Bushnell worked as an engineer in California for Ampex , an electronics company that worked in audio and video recording technology . He also met researcher Jim Stein , who worked for Stanford University 's Stanford Artificial Intelligence Project ; he learned from him that Spacewar was running on the laboratory 's PDP @-@ 6 , and played the game against him there when visiting . Soon after , he saw an ad for the Data General Nova computer , which cost only US \$ 4 @,@ 000 , and thought again about his Spacewar arcade game idea ; he believed that at that price , if he were able to connect four monitors and coin slots to allow multiple games to run simultaneously , the game would be economically viable . He showed his office mate and fellow Ampex engineer Ted Dabney Spacewar at the Stanford laboratory , and the two agreed to work together to try and design a prototype of the game ; Bushnell was more experienced with computers and digital engineering , while Dabney was more experienced with analog and hardware engineering , as he had been working on designing video processing and control circuits and power supplies .

After agreeing on an initial idea , Bushnell and Dabney began trying to design a prototype based on a Data General Nova . Initially they were joined by Larry Bryan , a computer programmer who also worked at Ampex . Bushnell and Dabney put US \$ 100 each into a partnership , named Syzygy by Bryan . They soon ran into difficulties with their planned design ; the computer was not powerful enough to refresh the monitors as fast as was needed to make the game playable . Bryan realized

this early on , when trying to design the code needed to run the games , and left the project before Syzygy was formed without ever contributing any money , but Bushnell and Dabney continued working on the design for several more months . The pair attempted to reduce the load on the computer by replacing subroutines ? such as displaying the background stars ? with specialized hardware , but it proved insufficient ; even reducing the number of monitors was not enough . By the end of November 1970 , Bushnell decided to abandon the project as untenable , while Dabney had stopped working on the design a while before . It is unclear if the pair were aware that Data General had demonstrated a more powerful variant of the Nova , sold for US \$ 8 @, @ 000 , running a single game of Spacewar at the Fall Joint Computer Conference in December 1968 , though that solution would have been too expensive for an arcade game , which typically cost US \$ 1 @, @ 000 at the time . Unable to put the game idea out of his mind , however , Bushnell soon thought of a way to manipulate the video signal on the screen without a computer controlling it , and from there Syzygy came up with the idea of removing the computer altogether and building specialized hardware to handle everything for the game instead .

Bushnell and Dabney began to design custom hardware to run the game 's functions , and they soon discovered that the cost to build the whole game 's computing systems would be much lower . As a result , they would not need to have multiple instances of the game running on the same machine in order to be profitable . On the other hand , however , the custom hardware was not as powerful as the more expensive Nova computer , which meant that the pair needed to make gameplay modifications . Spacewar was a two @-@ player game featuring dogfights around the gravitational field of a central star ; neither of these features could be run on the dedicated circuits the pair were making , so the game was cut down to a single @-@ player game wherein the player would fight against two computer @-@ controlled spaceships in open space . By January 1971 , the pair had built some basic hardware which could connect to a monitor , with plans to continue expanding it to make a game now named Cosmic Combat , but they were still far away from turning what was then a dot moving on a screen into a full Spacewar @-@ like game cabinet .

In January 1971 , Bushnell and Dabney founded Syzygy Engineering as an official company , now with a cash amount of US \$ 350 . They approached Ampex and a prior manager of Dabney 's with their prototype , but found no interest . The major arcade game manufacturers were based out of Chicago at the time , limiting their ability to demonstrate their idea to an existing firm . During a dentist appointment in early 1971 , Bushnell told the dentist about the game and that he was looking for a manufacturer ; the dentist in turn referred him to another patient of his , Dave Ralstin , the sales manager for Nutting Associates in Mountain View , California . Nutting had been founded in 1967 on the basis of Computer Quiz , an analog quiz arcade game , and by 1971 was looking for another hit game . After meeting with Bushnell , Nutting felt that his game was the potential success they needed to replace falling sales of Computer Quiz updates , as they had not had a hit game since . Nutting not only agreed to manufacture the game but also hired Bushnell as their chief engineer , as they had no real engineering team at the time . Furthermore , Syzygy Engineering retained ownership of the game , even though Nutting agreed to give Syzygy space to build the prototype and to manufacture the game once complete . Syzygy would be paid five percent of each cabinet sold . Bushnell negotiated to work on Cosmic Combat outside of normal working hours until it went into production in order to keep it conceptually separate from his new job at Nutting so as to prevent Nutting from later claiming ownership due to paying for time or materials spent building the game . Dabney remained at Ampex until the summer , when he resigned to join Bushnell at Nutting , as he was initially unwilling to leave the stable job he 'd worked at for ten years without more proof that the game could be a success .

= = Location tests and release = =

Once he moved to Nutting , Bushnell took over the majority of the engineering work for the game ; Dabney has stated that he advised Bushnell on some of the design , and that some of the construction was done by Steve Bristow , an intern at Ampex . There is disagreement in interviews with Bushnell and Dabney as to how much work Dabney did on the final cabinet , with Dabney

claiming credit for the controls , sound , power supply , initial wooden cabinet , and invention of the hyperspace color inversion , while Bushnell claims credit for everything but the sound , cabinet , power supply , and monitor . By August 1971 , an initial prototype of the game ? now named Computer Space to be similar to Computer Quiz ? was complete , and Syzygy moved on to location testing . They installed the game at the Dutch Goose bar near Stanford University , where it met with great success . Nutting was heartened by the response and rushed to make several finished cabinets for the Music Operators of America (MOA) Music & Amusement Machines Exposition in October . Further location tests found a less enthusiastic response from customers confused by the game mechanics and controls , and Syzygy hurriedly tried to adjust the game to be more understandable to players .

The final Computer Space design uses no microprocessor or memory ; the entire computer system is a state machine made of 74 @-@ series TTL chips , with graphic elements held in diode arrays . The array designs , which Bushnell designed to let him rotate the rocket in 16 directions with only 4 arrays , are laid out in the shape of the ships , which made it obvious to game operators what would need to be replaced if something broke . The ships themselves are projected on the screen as a pattern of dots , rather than connected lines , and the monitor they are projected on is a General Electric 15 @-@ inch black and white television screen , specially modified for the game . The rudimentary artificial intelligence constructed by Bushnell has the enemy ships firing towards the quadrant of the screen that the player 's rocket is in , rather than a more complicated tracking algorithm .

As Syzygy and Nutting prepared for the MOA show , Bushnell learned that another pair of engineers were also creating an arcade version of Spacewar . In August 1971 Bushnell called Bill Pitts and Hugh Tuck , operating as Computer Recreations , so that they could meet and discuss their solutions to the problem of running Spacewar on an inexpensive computer . Pitts and Tuck were almost finished with a prototype machine of Galaxy Game when they met with Bushnell ; the game , however , while a faithful recreation of Spacewar , ran on an externally @-@ connected DEC PDP @-@ 11 with a Hewlett @-@ Packard 1300A Electrostatic Display , and the total cost of the prototype unit was US \$ 20 @,@ 000 . The Syzygy duo were relieved , though also somewhat disappointed , to find that Galaxy Game was not using an innovative solution Syzygy had missed to build an economically @-@ competitive arcade game . Pitts and Tuck , conversely , felt that Computer Space was a pale imitation of Spacewar , while Galaxy Game was a superior adaptation of the game . They eventually produced two game prototypes , both displayed in the Stanford student union building , but never produced the game commercially due to the high cost of the cabinet .

Computer Space debuted at the MOA show on October 15 ? 17 , 1971 . Dabney 's wooden cabinet for the initial prototype was replaced with a curvy , futuristic fiberglass cabinet designed by Bushnell with modelling clay and built by a swimming pool manufacturer . A control panel extended from the main body of the cabinet and contained the four control buttons ; Syzygy had hoped to use a joystick to control the rocket 's movement , but found that it broke too easily , failing to last a single night in a location test . The Galaxy Game designers had run into the same issue , but had solved it with expensive customized military surplus joysticks . The cabinet displayed the Nutting Associates name and logo , along with the term " Syzygy engineered " . Nutting displayed four cabinets at the MOA show , one each in red , blue , white , and yellow , with the implication that the game was already in production , though they were in fact the only four cabinets then produced . These initial cabinets were in solid colors , though later ones would use a sparkle finish . The cabinets were damaged during transport , and one monitor was broken ; Syzygy repaired the three working cabinets and opened up the fourth to demonstrate the internals to attendees . Game distributors were hesitant about the game , with concerns raised about the game 's potential , reliability , and the embedded monitor 's attractiveness to thieves ; recollections are mixed as to whether Nutting took a handful or no orders at the show . Nutting , however , ordered a large production run regardless , on the expectation that the distributors would come around with further exposure . The game was displayed again at the International Association of Amusement Parks and Attractions show from November 9 ? 12 , and then entered production later that month .

= = Reception = =

Nutting ordered an initial production run of 1 @, @ 500 units of Computer Space , an optimistic decision given that a hit arcade game at the time would sell around 2 @, @ 000 units , though a handful had reached 10 @, @ 000 . Reception to the game from distributors was mixed ; while some were excited by the game , others felt it to be confusing and part of a passing video game fad . By spring 1972 the game had sold over 1 @, @ 000 units , and according to Bushnell in 1976 ended up selling between 1 @, @ 300 and 1 @, @ 500 units . While this was a commercial success , making over US \$ 1 @, @ 000 @, @ 000 , it was a disappointment to Nutting , who had been hoping for a large @-@ scale success like Computer Quiz . The game 's relative lack of success was attributed to the complexity of its controls and a steep learning curve , which pushed away customers used to less complex games . Bushnell noted that the locations that the game did well in , like the Dutch Goose playtest location , were generally located near university campuses ; the general market for coin @-@ operated games , however , was in working @-@ class bars , where the patrons were less interested in deciphering a complicated game . In the documentary Video Game Invasion : The History of a Global Obsession , Bushnell explained , " Sure , I loved it , and all my friends loved it , but all my friends were engineers . It was a little too complicated for the guy with the beer in the bar . " Bushnell has also stated that part of the difficulty lay in the novelty of the game ; he has said that even a few years later the controls and gameplay would have been more understandable to players who would have seen other video games by then . Conversely , Bushnell and Dabney have said that the game 's novelty was also part of its appeal to players ? most people had never seen a television screen displaying images being controlled by a person in front of it , rather than playing video from a remote television station .

While the game did not meet the high hopes of Nutting , it was successful enough that Nutting produced a two @-@ player version of the game in July 1973 with a green fiberglass cabinet , built by Steve Bristow ; the design was initially contracted to Bushnell , but was either uncompleted or unused . The game had no further involvement from Bushnell or Dabney , and was not a large success . Additionally , although the biggest successes in arcade games at the time generally spawned a dozen copycat games , Computer Space had only a single clone , produced in 1972 by For @-@ Play Manufacturers as Star Trek . The game and its cabinet bore little resemblance to the television show itself . A custom white Computer Space cabinet appeared in the 1973 film Soylent Green as a futuristic entertainment device , marking the first appearance of a video game in a movie .

By May 1972 , Bushnell and Dabney quit Nutting Associates and moved to incorporate Syzygy Engineering ; they instead named it Atari due to another company with a similar name . Bushnell later stated that he was encouraged by the success of Computer Space in regards to future game ideas , as he had never before created something that made so much money , and additionally felt that his time at Nutting gave him confidence in running his own company because he " couldn 't screw it up more than they did " . Nutting Associates did not make any further Computer Space games before closing in 1976 . Bushnell 's enthusiasm was soon substantiated , as Atari 's first game , Pong , went on to substantially greater success than Computer Space . Although not as influential as Pong , Computer Space 's release marked the beginning of the commercial video game industry .