

◆ CHAPTER 1 ◆

THE ROBOT AND THE WITCH

TALOS AND MEDEA

THE FIRST “ROBOT” to walk the earth—in ancient Greek mythology—was a bronze giant called Talos.

Talos was an animated statue that guarded the island of Crete, one of three wondrous gifts fashioned by Hephaestus, god of the forge and patron of invention and technology. These marvels were commissioned by Zeus, for his son, Minos, the legendary first king of Crete. The other two gifts were a golden quiver of drone-like arrows that never missed their mark and Laelaps, a golden hound that always caught its prey. The bronze automaton Talos was charged with the task of defending Crete against pirates.¹

Talos patrolled Minos’s kingdom by marching around the perimeter of the large island three times each day. As an animated metal machine in the form of a man, able to carry out complex human-like actions, Talos can be spoken of as an imagined android robot, an automaton “constructed to move on its own.”² Designed and built by Hephaestus to repel invasions, Talos was “programmed” to spot strangers and pick up and hurl boulders to sink any foreign vessels that approached Crete’s shores. Talos possessed another capability too, modeled on a human trait. In close combat, the mechanical giant could perform a ghastly perversion of the universal gesture of human warmth, the embrace. With the ability to heat his bronze body red-hot, Talos would hug victims to his chest and roast them alive.

The automaton’s most memorable appearance in mythology occurs near the end of the *Argonautica*, the epic poem by Apollonius of Rhodes describing the adventures of the Greek hero Jason and the Argonauts

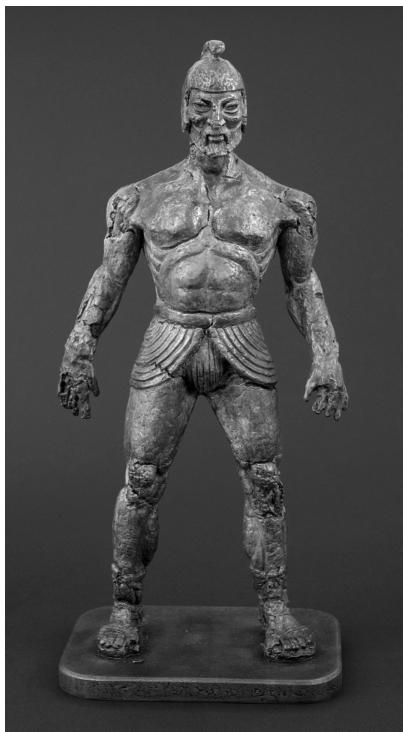


FIG. 1.1. Talos, bronze cast of the crumpling original model made by Ray Harryhausen for the film *Jason and the Argonauts* (1963), forged 2014 by Simon Fearnham, Raven Armoury, Dunmow Road, Thaxted, Essex, England.

however, Talos was described as a technological production, envisioned as a bronze automaton constructed by Hephaestus and placed on Crete to do a job. Talos's abilities were powered by an internal system of divine ichor, the “blood” of the immortal gods. This raises questions: Was Talos immortal? Was he a soulless machine or a sentient being? These uncertainties would prove crucial to the Argonauts, although the answers remain ambiguous.



In the final book of the *Argonautica*, Jason and the Argonauts are homeward bound with the precious Golden Fleece. But their ship, the *Argo*, has been becalmed. With no winds to fill their sails, exhausted from days

and their quest for the Golden Fleece. Today the Talos episode is familiar to many thanks to the unforgettable stop-motion animation of the bronze robot created by Ray Harryhausen for the cult film *Jason and the Argonauts* (1963; fig. 1.1 is a bronze cast of the original model).³

When he composed his epic poem *Argonautica* in the third century BC, Apollonius drew on much older oral and written versions of the myths of Jason, Medea, and Talos, stories that were already well known to his audience. An antiquarian writing in a deliberately archaic style, at one point Apollonius casts Talos as a survivor or relict from the “Age of Bronze Men.” This was an ornate allusion to a conceit in a figurative passage about the deep past taken from the poet Hesiod’s *Works and Days* (750–650 BC).⁴ In the *Argonautica* and other versions of the myth,

of rowing, the Argonauts make their way into a sheltered bay between two high cliffs on Crete. Immediately Talos spots them. The great bronze warrior begins breaking off rocks from the cliff and heaves them at the ship. How could the Argonauts escape the clutches of this monstrous android? Quaking in fear, the sailors desperately attempt to flee the terrifying colossus astride the rocky harbor.

It is the sorceress Medea who comes to their rescue.

A beautiful princess from the kingdom of Colchis on the Black Sea, the land of the Golden Fleece, Medea was a bewitching femme fatale with her own set of mythic adventures. She possessed the keys to youth and age, life and death. She could hypnotize man and beast, and she could cast spells and brew powerful potions. Medea understood how to defend against flames, and she knew the secrets of the unquenchable “liquid fire” known as “Medea’s oil,” a reference to volatile naphtha from natural petroleum wells around the Caspian Sea. In Seneca’s tragedy *Medea* (lines 820–30, written in the first century AD), the sorceress keeps this “magical fire” in an airtight golden casket and claims that the fire-bringer Prometheus himself taught her how to store its powers.⁵

Before their landfall in Crete, Medea had already helped Jason on his expedition to win the Golden Fleece. Medea’s father, King Aeetes, promised to give Jason the Fleece if he could complete an impossible, deadly task. Aeetes owned a pair of hulking bronze bulls created by Hephaestus. Aeetes ordered Jason to yoke the fire-breathing bronze beasts and plow a field while sowing the earth with dragon’s teeth that would sprout an instant army of android soldiers. Medea decided to save the handsome hero from certain death, and she and Jason became lovers (for the full story of how Jason dealt with the robo-bulls and the dragon-teeth army, see chapter 4).⁶

The lovers had to flee the enraged King Aeetes. Medea—whose own golden chariot was drawn by a pair of tame dragons—guided Jason to the lair of the dreadful dragon that guarded the Golden Fleece. With her shrewd psychological insight, powerful *pharmaka* (drugs), and *technai* (devices), Medea overcame the dragon.⁷ Murmuring incantations, dipping into her store of exotic herbs and rare substances gathered from remote crags and meadows high in the Caucasus Mountains, Medea lulled the dragon into a deep sleep and seized the Golden Fleece for Jason. Medea and Jason absconded with the prize to the *Argo*, and she accompanied the Argonauts on their homeward voyage.

Now, facing the threat of the looming bronze automaton blocking their way, Medea takes charge again. *Wait!* she commands Jason's fearful sailors. *Talos's body may be bronze, but we don't know whether he is immortal. I think I can defeat him.*

Medea (from *medeia*, "cunning," related to *medos*, "plan, devise") prepares to destroy Talos. In the *Argonautica*, Medea uses mind control and her special knowledge of the robot's physiology. She knows that the blacksmith god Hephaestus constructed Talos with a single internal artery or tube through which ichor, the ethereal life-fluid of the gods, pulsed from his head to his feet. Talos's biomimetic "vivisystem" was sealed by a bronze nail or bolt at his ankle. Medea realizes that the robot's ankle is his point of physical vulnerability.⁸

Apollonius describes Jason and the Argonauts standing back in awe, to watch the epic duel between the powerful witch and the terrible robot. Muttering mystical words to summon malevolent spirits, gnashing her teeth with fury, Medea fixes her penetrating gaze on Talos's eyes. The witch beams a kind of baleful "telepathy" that disorients the giant. Talos stumbles as he picks up another boulder to throw. A sharp rock nicks his ankle, opening the robot's single vein. As his life force bleeds away "like melted lead," Talos sways like a great pine tree chopped at the base of its trunk. With a thunderous crash, the mighty bronze giant topples onto the beach.

It is interesting to speculate about this death scene of Talos as it was depicted in the *Argonautica*. Was the vivid image influenced by the sensational collapse of a real monumental bronze statue? Scholars have suggested that Apollonius, who spent time in Rhodes, had in mind the magnificent Colossus of Rhodes, built in 280 BC with sophisticated engineering techniques involving a complex internal structure and external bronze cladding. One of the Seven Wonders of the Ancient World, it stood about 108 feet tall, roughly the size of the Statue of Liberty in New York Harbor. Unlike the mythical Talos, who spent his days in constant motion, the immense figure of Helios ("Sun") did not have moving parts but served as a lighthouse and gateway to the island. The Colossus was demolished by a powerful earthquake during Apollonius's lifetime, in 226 BC. The massive bronze statue broke off at the knees and crashed into the sea.⁹

Other models were also at hand. Apollonius was writing in the third century BC, when an array of self-moving machines and automata were

being made and displayed in Alexandria, Egypt, a lively center for engineering innovations. A native of Alexandria, Apollodorus served as head of the great library there (P. Oxy. 12.41). Apollodorus's descriptions of the automaton Talos (and a drone-like eagle, chapter 6) suggest his familiarity with Alexandria's famous automated statues and mechanical devices (chapter 9).



In older versions of the Talos story, technology and psychology are even more prominent—and ambiguous. Does his metallurgic origin make Talos completely inhuman? Notably, the question of whether Talos has agency or feelings is never fully resolved in the myths. Even though he was “made, not born,” Talos seems somehow tragically human, even heroic, cut down by a ruse while carrying out his assigned duties. In the other, more complex descriptions of his downfall, Medea subdues the bronze giant with her spellbinding *pharmaka*, then uses her powers of suggestion, compelling Talos to hallucinate a nightmare vision of his own violent death. Next, Medea plays on the automaton’s “emotions.” In these versions, Talos is portrayed as susceptible to human fears and hopes, with a kind of volition and intelligence. Medea convinces Talos that she can make him immortal—but only by removing the bronze rivet in his ankle. Talos agrees. When this essential seal on his ankle is dislodged, the ichor flows out like molten lead, and his “life” ebbs away.

For readers today, the robot’s slow demise might call to mind the iconic scene in Stanley Kubrick’s *2001: A Space Odyssey* (1968). As the doomed computer HAL’s memory banks fade and blink out, HAL begins to recite the story of his “birth.” But HAL was *made, not born*, and his “birth” is a fiction implanted by his manufacturers, much as eidetic, emotional memories are manufactured and implanted in the replicants in the *Blade Runner* films (1982, 2017). Recent studies in human-robot interactions show that people tend to anthropomorphize robots and Artificial Intelligence if the entities “act like” humans and have a name and a personal “story.” Robots are not sentient, and have no subjective feelings, yet we endow self-moving objects that mimic human behavior with emotions and the ability to suffer, and we feel pangs of empathy for them when they are damaged or destroyed. In the film *Jason and*

the Argonauts, despite the expressionless face of the monolithic bronze automaton, Harryhausen's astonishing animation sequence suggests glimmers of personality and intellect in Talos. In the poignant "death" scene, as his life-fluid bleeds out, the great robot struggles to breathe and gestures helplessly at his throat while his bronze body cracks and crumbles. The modern audience feels pity for "the helpless giant and regrets that he was taken in unfairly" by Medea's trick.¹⁰

In the fifth century BC, Talos was featured in a Greek tragedy by Sophocles (497–406 BC).¹¹ Unfortunately, that play is lost, but it is easy to imagine that the fate of Talos might have evoked similar pathos in antiquity. One can appreciate how oral retellings and tragic dramas would have elicited compassion for Talos, especially since he behaved in a human-like way and his name and backstory were well known. Indeed, there is ample evidence that ancient vase painters humanized Talos in illustrations of his death.



We have only fragments of the many stories about the Cretan robot that circulated in antiquity, and some versions are lost to us. Illustrations on vases and coins help to fill out the picture, and some artistic images of Talos contain details unknown in surviving literature. The coins of the city of Phaistos, one of the three great Minoan cities of Bronze Age Crete, are an example. Phaistos commemorated King Minos's bronze guardian Talos on silver coins from about 350 to 280 BC. The coins show a menacing Talos facing forward or in profile, hurling stones. No surviving ancient source says Talos had wings or flew, but on the Phaistos coins Talos has wings. The wings could be a symbolic motif that signaled his nonhuman status or they might suggest his superhuman speed as he circled the island (this would entail traveling more than 150 miles per hour by some calculations). On the reverse of some of the Phaistos coins Talos is accompanied by the Golden Hound Laelaps, one of the three engineering marvels made by Hephaestus for King Minos. The wonder-dog has its own body of ancient folklore (chapter 7).¹²

About two centuries before Apollonius wrote the *Argonautica*, Talos appeared on red-figure Greek vase paintings of about 430 to 400 BC. The details on some of the vases show that Talos's internal "biostructure,"



FIG. 1.2. Talos hurling stones on coins of Phaistos, Crete. Left, silver stater, fourth century BC (reverse shows a bull). Theodora Wilbur Fund in memory of Zoe Wilbur, 65.1291. Right, Talos in profile, bronze coin, third century BC (reverse shows the Golden Hound). Gift of Mr. and Mrs. Cornelius C. Vermeule III, 1998.616. Photographs © 2018 Museum of Fine Arts, Boston.

the ichor-filled artery system sealed by a bolt at his ankle, was already a familiar part of the story as early as the fifth century BC. The similarities and style of the scenes suggest that the vase paintings might be miniature copies of large public wall murals painted by Polygnotus and Mikon, renowned artists of Athens in the fifth century BC. The ancient Greek travel writer Pausanias (8.11.3) tells us that Mikon painted episodes from the epic saga of Jason and the Golden Fleece in the Temple of Castor and Pollux (the Dioscuri twins were honored in the Anakeion, chapter 2).

Those murals admired by Pausanias in the second century AD are now lost, but surviving images on vases reveal how Talos was imagined in the classical era. The artists show Talos as part machine, part human, whose destruction required technology. The paintings also convey a sense of pathos in his destruction. For example, the dramatic scene on the extraordinary “Talos vase,” a large wine vessel made in Athens in about 410–400 BC, shows Medea mesmerizing the large man of bronze (figs. 1.3 and 1.4, plate 1).

Cradling her bowl of drugs, Medea gazes intently as Talos swoons into the arms of Castor and Pollux. In Greek myth, the Dioscuri twins had joined the Argonauts, but no surviving stories include them in the death of Talos, so this image points to a lost tale. The Talos Painter depicts Talos with a robust metal body like that of a bronze statue; his torso looks

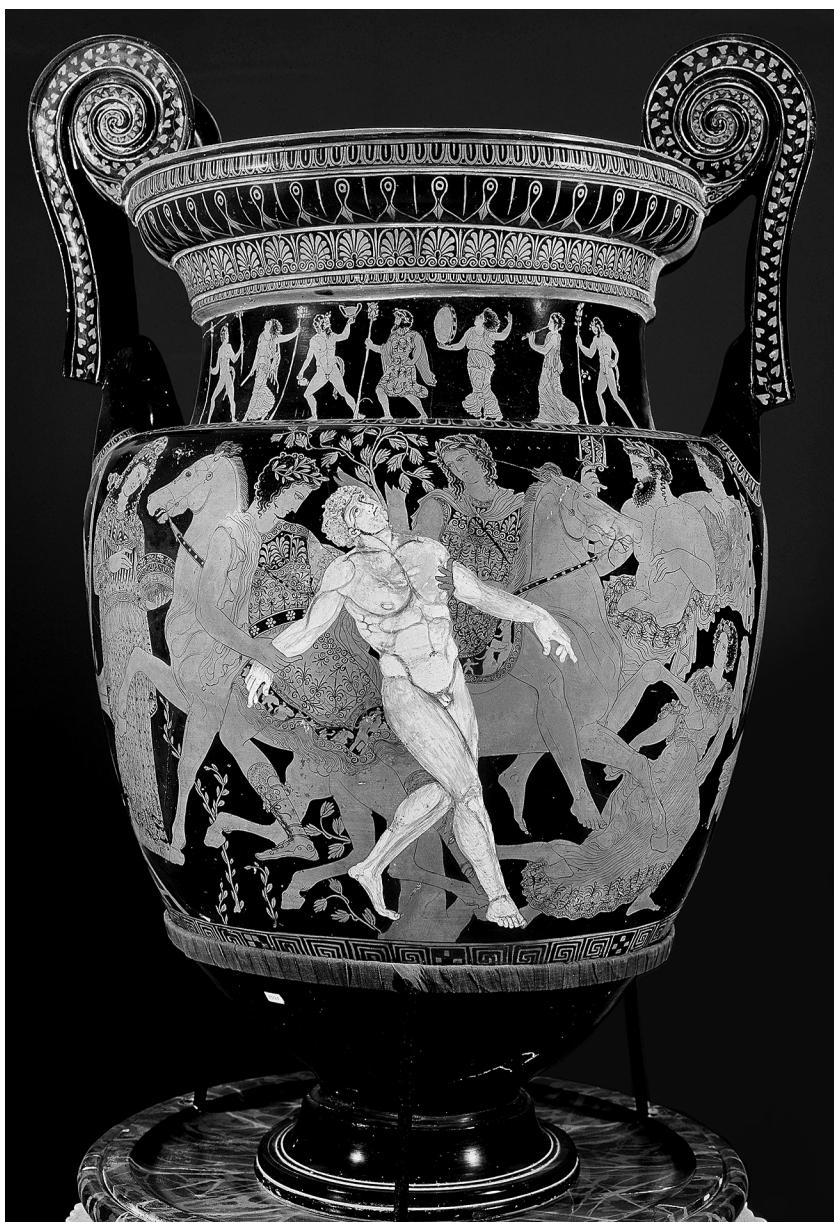


FIG. 1.3. “Death of Talos,” The metallic robot Talos swoons into the arms of Castor and Pollux, as Medea holds a bowl of drugs and gazes malevolently. Red-figure volute krater, fifth century BC, by the Talos Painter, from Ruvo, Museo Jatta, Ruvo di Puglia, Album / Art Resource, NY.

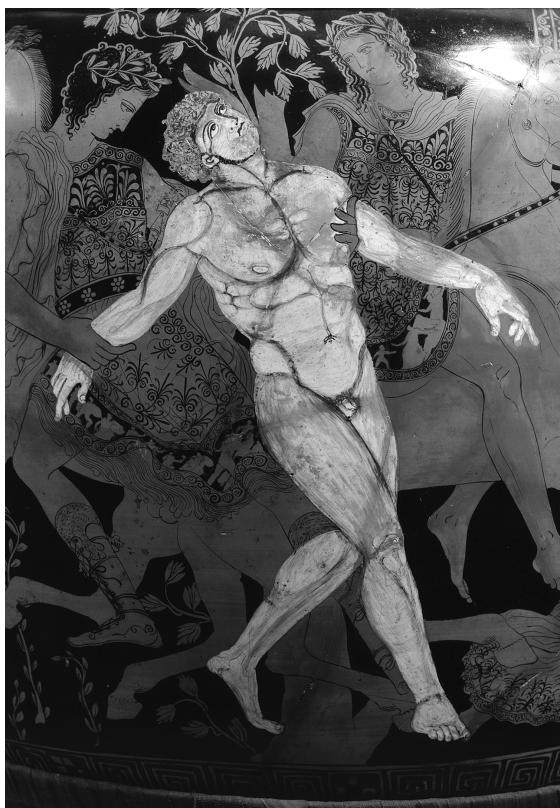


FIG. 1.4 (PLATE 1). “Death of Talos,” Ruvo vase detail. Album / Art Resource, NY.

like the realistic, heavily muscled bronze chest armor worn by Greek warriors (chapter 7, fig. 7.3). Employing the same technique used for images of warriors wearing bronze “muscle armor,” the artist painted Talos’s entire body yellowish-white to distinguish his bronze plating from human flesh. But despite his metallic form, Talos’s posture and his face are humanized to evoke empathy. One classical scholar even detects “a teardrop . . . falling from Talos’ right eye,” although this line might represent metallic molding or seams, like the other reddish outlines defining the robot’s anatomy.¹³

An earlier (440–430 BC) vase painting on an Attic krater found in southern Italy shows Talos as a tall bearded figure reeling off balance, again struggling against Castor and Pollux (figs. 1.5, 1.6, plate 2). This



FIG. 1.5 (PLATE 2). Medea watches as Jason uses a tool to unseal the bolt in Talos's ankle held by a small winged figure of Death, as Talos collapses into the arms of Castor and Pollux. Red-figure krater, 450–400 BC, found at Montesarchio, Italy. “Cratere raffigurante la morte di Talos,” Museo Archeologico del Sannio Caudino, Montesarchio, per gentile concessione del Ministero dei Beni e delle Attività Culturali e del Turismo, fototeca del Polo Museale della Campania.



FIG 1.6. Detail of the Montesarchio krater, showing Jason using a tool to remove the bolt in Talos's ankle. Drawing by Michele Angel.

scene includes several striking details confirming the technological character of Talos's vivisystem and destruction. We see Jason kneeling next to the robot's right foot, applying a tool to the small round bolt on Talos's ankle. Leaning over Jason, Medea is holding her bowl of drugs. A small winged figure of Thanatos (Death) grasps and steadies Talos's foot. Death's stance, posed on one foot with the other bent back, appears to replicate the death throes of Talos.

A similar scene showing the use of a tool appears on an Attic vase fragment of about 400 BC found in Spina, an Etruscan port on the Adriatic Sea. Talos is again seized by Castor and Pollux. At Talos's feet, Medea holds a box on her lap and a blade in her right hand, ready to remove the nail on his ankle. Another tiny winged figure of Death points at Talos's legs, heightening the suspense of the vignette.¹⁴

In the Greek myth of Jason and the Argonauts, the bronze colossus was a dire obstacle to be vanquished. For King Minos of Crete, however, Talos was a boon, an early warning system and frontline defense for his strong navy. Likewise, the Etruscans, dominant in northern Italy from about 700 to 500 BC, regarded the guardian Talos as a heroic figure. Greek myths were favorite subjects for Etruscans, who imported shiploads of Attic vases decorated with familiar scenes and characters from mythology. The Etruscans often gave the Hellenic stories a local spin, however, reflected in their own artworks. Talos appears on several engraved Etruscan bronze mirrors of about 500–400 BC, when Roman power was rising as a threat to Etruria.

An Etruscan mirror in the British Museum shows Talos, identified by his Etruscan name, Chaluchasu. He is struggling with two Argonauts identified, in Etruscan-language inscriptions, as Castor and Pollux. A woman leans down to open a small box while reaching out toward Talos's lower leg (see the drawing in fig. 1.7). The scene replicates the actions of Medea in the Athenian vase paintings, but the woman is labeled "Turan," the Etruscan name for the goddess of love, Aphrodite, suggesting an alternative, unknown version of the Greek myth.

Other Etruscan bronze mirrors show a victorious Talos/Chaluchasu crushing his antagonists, perhaps reflecting his ability to roast victims by hugging them to his heated chest (fig. 1.7). Scholars conclude that a local Italian tradition glorified Talos, emphasizing the bronze robot's original purpose as the guardian of Crete's shores. The mirrors show that



FIG. 1.7. Top, Talos crushing Castor and Pollux to his chest, while a woman opens a box and reaches toward Talos's ankle. Etruscan bronze mirror, about 460 BC, drawing, 1859,0301.30. © The Trustees of the British Museum. Bottom, Talos crushing two men, Etruscan bronze mirror, 30480 Antikensammlung Staatliche Museen, Berlin, photo by Sailko (Francesko Bini), 2014.

the Etruscans considered Talos/Chaluchasu as a positive heroic figure whose “invincibility helped to overpower trespassers [and] strangers” at a time when Etruscans were facing Rome’s incursions into their territory.¹⁵



How ancient is the Talos tale? That is uncertain; but, as we saw, Talos appears in art of the early fifth century BC. Stories about other animated statues and self-moving devices serving the gods on Mount Olympus are found in archaic oral traditions that were first set down in writing in about 750 BC in Homer’s *Iliad*, the epic poem about the legendary Trojan War set in the Bronze Age (ca. 1150 BC).¹⁶ In classical antiquity, it was believed that King Minos of Crete had ruled three generations before the Trojan War. Renowned for his laws and for the strong navy he built to suppress piracy, Minos was treated as a “historical” ruler by the fifth-century BC historians Herodotus (3.122) and Thucydides (1.4) and later by Diodorus Siculus (4.60.3), Plutarch (*Theseus* 16), and Pausanias (3.2.4), among others. Modern archaeologists named the Minoan civilization (3000–1100 BC) after the legendary King Minos.

Minoan-era seals from Crete depict many bizarre monsters and demons, which apparently served as guardians of cities and talismans. A bull-headed man, the Minotaur, appears on some Minoan seals. One Late Minoan seal stamp, known as the Master Impression (1450–1400 BC), is quite striking. It shows a fortified city on a hill above a rocky seashore (matching the topography of Kastelli Hill, Kydonia, modern Chania, Crete, where the seal was discovered). A gigantic faceless male figure, “unusually sturdy and strongly built,” looms atop the highest point of the city. The enigmatic figure does not represent Talos of Greek myth. But if this and similar seals circulated in the Greek world in antiquity, it is possible that a scene like this—a giant seemingly guarding a Minoan city—might have influenced early oral traditions about Talos defending Crete for King Minos. That is speculation, of course, and in the absence of any literary texts the meaning of the scene on the Minoan seal remains a mystery.¹⁷

King Minos figured in other ancient tales of technology associated with the legendary craftsman Daedalus, whose works were sometimes conflated with those of the inventor god Hephaestus (chapters 4 and 5). In

any event, it is clear that Talos, the bronze automaton of Crete, was well known in Greek poetry and artworks long before Apollonius of Rhodes wrote his *Argonautica* in the third century BC. Besides Pindar (*Pythian* 4, ca. 462 BC), Apollonius's sources for Talos are unknown, but some scholars believe that the epic traditions about the *Argo*'s voyage are even older than the Trojan War stories.¹⁸ So the tale of Talos could be very ancient indeed.

Talos appeared in the lost tragedy *Daedalus* by Sophocles in the fifth century BC. But the earliest written description of Talos is in a fragment of a poem by Simonides (556–468 BC). Simonides calls Talos a *phylax empsychos*, an “animated guardian,” made by Hephaestus. Notably, Simonides says that before taking up guard duties on Crete, the great bronze warrior had destroyed many men by crushing them in his burning embrace on Sardinia. Sardinia, the large island west of Italy, was renowned for copper, lead, and bronze metallurgy in antiquity. Sardinia

had long-standing ties to Crete dating back to the Bronze Age, and the Etruscans traded and settled in Sardinia as early as the ninth century BC.¹⁹ During the Nuragic civilization of Sardinia, which flourished from about 950 to 700 BC, smiths forged myriad bronze figures using lost-wax casting. Nuragic sculptors employed surprisingly sophisticated tools to create a phalanx of giant stone statues that stood watch on Sardinia (see also chapter 5). Ranging from 6.5 to 8 feet tall, the imposing stone figures are concentrated at Mont'e Pramo on the west coast of the island. These remarkable Nuragic statues are the earliest anthropomorphic large sculptures in the Mediterranean region, after the colossi of Egypt.

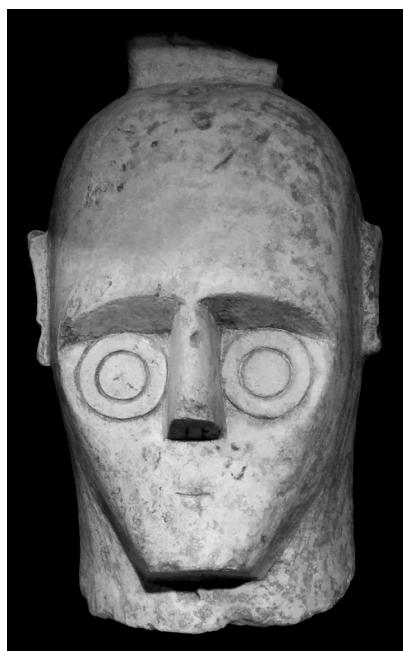


FIG. 1.8. Ancient stone giant of Mont'e Pramo, Sardinia, Nuragic culture, about 900–700 BC. National Archaeological Museum, Cagliari, Sardinia.

The enigmatic giants of Sardinia have distinctive faces: large concentric discs for eyes and small slits for mouths (fig. 1.8). It's easy to see why these simple facial features are humorously likened to those of typical modern robots in popular science fiction, such as the droid C-3PO in the *Star Wars* films (1977–2017). Since 1974, archaeologists have unearthed forty-four of the great stone men at Mont'e Prama on Sardinia. The giants are believed to have served as sacred guardians. If so, they would have fulfilled the same function as Talos and other border-protecting statues in antiquity.

Was the poet Pindar's claim that the giant automaton Talos had once defended Sardinia somehow related to ancient Greek observations or reports of the towering stone giants of the island? Curiously enough, an island defended by boulder-hurling giants, the Laestrygonians, appears in Homer's *Odyssey* (10.82, 23.318). The Laestrygonians' name sounds similar to that of the Lestrigoni, a tribe that inhabited northwest Sardinia. It has been suggested that the Homeric tale of the giants defending the island by throwing rocks could have arisen from sailors' sightings of the colossal figures on Sardinia.²⁰ The similarity to the actions of Talos is striking.



Some modern historians of automata have misunderstood Talos as inert matter supernaturally instilled with life by the gods via magic. In his history of European automata, for example, Minsoo Kang divides the automata described in antiquity into four categories: (1) mythic creatures that resemble modern robots only in appearance; (2) mythic objects of human manufacture brought to life with magic; (3) historical objects of human design; and (4) speculative automata in theoretical inquiries of moral concepts. Kang places Talos in his first category of “mythic creatures” that look like robots but were created by “supernatural power with no reference to mechanical craft.” The “imaginary significance” of automata like Talos “in the premodern period had little to do with mechanistic ideas,” asserts Kang, who claims that Talos was “not a mechanical being but very much a living creature.”²¹ But ancient sources describe Talos as “made, not born.” As we saw, Talos’s internal anatomy and movements were explained through mechanistic concepts, and this was echoed in ancient artistic depictions: What living creature has a metallic body and a nonblood circulatory system sealed with a bolt? Moreover, the mythic accounts and

fifth-century BC artworks illustrating the destruction of Talos show that his demise required technology, specifically the removal of the bolt.

The exact definition of the term *robot* is debatable, but the basic conditions are met by Talos: a self-moving android with a power source that provides energy, “programmed” to “sense” its surroundings and possessing a kind of “intelligence” or way of processing data to “decide” to interact with the environment to perform actions or tasks. Kang’s notion that ancient ideas about technology played no role in the Talos myth is based, first, on a faulty comparison to the divine creation of Adam from mud or clay in the Old Testament, and, second, on a cursory reading of the one passage in the *Argonautica* (4.1638–42) referring to Talos as the last of a “race of bronze men,” the archaizing poetic trope mentioned above.²²

Philosopher of science Sylvia Berryman maintains that the Olympian gods were not portrayed as using technology in Greek myths, and that devices made by Hephaestus were not animated by craft. But Talos’s maker, Hephaestus, was the god of metallurgy, technology, and invention, usually depicted at work with his tools, and his productions were imagined as designed and constructed with implements and craft. In Berryman’s view, Talos cannot represent a “technologically produced working artifact” because he has no “physical means by which [he] is said to work.”²³ But Talos is outstanding among mythic artificial beings because ancient writers and artists represented Talos as an *automaton*, a “self-mover,” a bronze statue animated by “an internal mechanism,” in this case the single tube or vessel containing a special fluid, a system that was described in biological, medical, and machine-like terms.

Classical historian Clara Bosak-Schroeder cautions, rightly, that we moderns must guard against “projecting our technological understandings onto the past.” She suggests that in similar fashion the Hellenistic Greeks might have projected their knowledge of innovations back onto their ancient myths. Following Kang and Berryman, Bosak-Schroeder assumes that all mythic examples of “automata were originally imagined as purely magical,” and states that “the advent of advanced mechanics later in antiquity . . . caused Greeks in the Hellenistic and Roman ages to reinterpret magical automata as mechanical.” But the argument that a form of “relative modernism” led the Greeks to retroject their current technology onto imaginary automata in their myths and legends does not apply in the case of Talos and other mythic examples of artificial life

that were described as fabricated by Hesiod, Homer, Pindar, and other classical sources.²⁴ As discussed in chapter 9, some historical self-moving devices appeared in the fourth century BC. Moreover, Talos's features cannot be interpreted as backward projections from the Hellenistic era because, as we saw, even in the earliest versions of the myth and in artworks, Talos was already imagined as a construction, a “self-moving or self-sustaining manufactured object [that] mimicked a natural living form,” the typical definition of a robot.²⁵

It seems that a more meaningful, nuanced approach to Talos and other animated statues of antiquity would recognize how “mythology blurs the distinction between technology and divine power.”²⁶ There is a difference between stories of gods wishing or commanding inert matter to become alive, as in the biblical Adam and the myth of Pygmalion’s statue (chapter 6), and gods using superior forms of technology to construct artificial life, even if the inner workings are not described. As numerous scholars have pointed out, in myths about crafted beings like Talos, Pandora, and others, the artificial beings are seen as the products of divine artisanship, not just divine will. Indeed, “the mystical and technological approaches to making artificial life are not as distinct” as many believe, argues E. R. Truitt, a historian of medieval automata. Truitt explains that the promise of technologies such as metalworking “was precisely that it offered the possibility of surpassing” the ordinary limitations of human creations and ingenuity.²⁷

In many of the ancient myths and legends presented in this book, artificial beings are made of the same substances and by the same methods that human craftspeople use to make tools, instruments, weapons, statues, buildings, devices, and artworks, but with marvelous results befitting divine expertise. Talos and his ilk are examples of artificial beings created, not simply by magic spells or divine fiat, as many historians and philosophers of science and technology have assumed, but by what ancient Greeks might have called *biotechnē*, from *bios* “life” and *techne*, “crafted through art or science.”²⁸

Hephaestus, the smith god of invention, fabricated Talos in his heavenly foundry, which was imagined as resembling but far surpassing real bronze foundries on earth—with vastly superior technology, capable of producing “living” and self-moving machines (chapter 7). Bronze, an alloy of copper and tin, was the hardest, most durable man-made material

of the eponymous Bronze Age. In the subsequent Iron Age, arcane bronze and bronze-making technologies retained an aura of the supernatural among ordinary folk. In popular superstition, figures made of bronze were believed to enchant or to ward off evil. Bronze guardian statues were often placed at borders, boundaries, bridges, gates, and harbors.²⁹ The brazen forms of the mythical Talos of Crete and the historical Colossus of Rhodes might have been thought to exert a kind of magic-shield effect, but both were engineered with complex internal structures.

From antiquity into the Middle Ages, bronze was the favored material for making “living machines” and automata. Not only did bronze casting require “trade secrets,” esoteric knowledge and skills, but casting could reproduce human and animal forms in metal with a preternatural verisimilitude. This may have led to early Greek smiths being “perceived as magicians,” notes Sandra Blakely in her history of metallurgy. But, Blakely continues, “to call an artisan a magician may simply be hyperbolic praise of his technical skills,” especially in the case of “artifacts that seem to come alive.” In the lost-wax method of bronze casting, described below, the likeness of a person or animal can seem to appear by magic. As science-fiction futurist Arthur C. Clarke’s well-known Third Law states: “Any sufficiently advanced technology is indistinguishable from magic.” By creating an eerie imitation of a living thing, an inventive god—or human inventor—might also “seek to replicate the animation” of that thing.³⁰ In the logic of magical thinking, the bronze object’s uncanny replication of life suggests the notion that the simulacrum might also include self-movement and agency.³¹

Attributing magic to metallurgy could also reflect technological mastery of natural science extrapolated to metalworking, remarks Blakely. According to ancient Greek legend, the discovery of the art of pouring molten metal into crucibles occurred after a forest fire on a mountain. The “intense heat melted the ores hidden inside the earth,” and as the molten ores flowed down the mountain, they filled cavities on the rocky surface, taking their exact forms.³²

Contemplating the descriptions of Talos’s biotechnology—the single vessel running from his head to his feet secured with a seal—and the way that once the seal was opened, the ichor poured out like molten lead, classical scholar A. B. Cook proposed an intriguing theory drawing on ancient metallurgy. Cook suggested that the distinctive physiology of

Talos might have symbolized or alluded to lost-wax casting in the Bronze Age. Like other bronze figurines and large bronze statues of antiquity, Talos himself would have been wrought by a lost-wax method.³³

A finely detailed early fifth-century BC red-figure cup in Berlin, the Foundry Vase, illustrates artisans creating two lifelike bronze statues using foundry tools and techniques, including the sophisticated lost-wax method. The statue of an athlete is in process, with parts of the body as yet unconnected (fig. 1.9, plate 3; compare figs 6.3–11 for images of Prometheus constructing the first man in sections). On the other side of the vase, we see workers finishing a larger-than-life, realistic statue of a warrior (fig. 1.10).

The ancient lost-wax technology is incompletely known, but one method involved making a rough clay model or a wooden armature, which was coated with beeswax. Then the finer details were carved and molded in the wax by the sculptor. This wax model was covered with a thin clay slip, followed by successively thicker layers to make a mold. The



FIG. 1.9 (PLATE 3). Foundry scene, artisans making a realistic bronze statue of an athlete, in pieces, surrounded by blacksmith tools. Attic red-figure kylix, from Vulci, about 490–480 BC, by the Foundry Painter. Bpk Bildagentur / Photo by Johannes Laurentius / Antikensammlung, Staatliche Museen, Berlin / Art Resource, NY.



FIG. 1.10. Foundry scene, workers finishing a statue of a warrior. Attic red-figure kylix, from Vulci, about 490–480 BC, by the Foundry Painter. Bpk Bildagentur / Photo by Johannes Laurentius / Antikensammlung, Staatliche Museen, Berlin / Art Resource, NY.

core of the now-formless mass was pierced by a hollow bronze rod, from head to feet. This tube allowed the melting wax to pour out of the feet when the form was placed in a fiery furnace. Molten bronze, with lead added for plasticity and to increase flow, was next poured between the inner and outer molds where the wax had once been, to create the hollow statue. Notably, Talos heated his body by leaping into a fire, according to the poet Simonides, and his ichor flowed out at his feet.³⁴



Magic and mysterious biomechanics obviously overlap in the myths about artificial life expressed in folklore terms. But in the various narratives about Talos, it is striking that the physiology of the bronze automaton was described in mytho-technical language, alluding to medical and scientific concepts current in antiquity.³⁵

In the realm of myth, for example, the word *ichor* was used in a special sense for the “blood” of the gods. But in ancient medical and natural

science contexts, *ichor* denoted the watery, amber-colored blood serum of mammals. Moreover, in the *Argonautica*, the poet's word for the vital vein that made up the bronze giant's circulation system was a technical term for blood vessels in Greek medical treatises. The imaginary integration of living and nonliving components, melding biology with metallurgical "mechanics," makes Talos into a kind of ancient cyborg with biomechanical body parts.³⁶

Talos, as an android constructed in Hephaestus's divine foundry and animated by *ichor*, was presumably intended to be a perpetual-motion machine. In the myth Talos seems to evince inklings of consciousness and an "instinct" for survival, and he acquiesced to Medea's persuasion, indicating agency and volition. But Talos is unaware of his origins and does not understand his own physiology. And indeed, how should his nature be understood? According to the lost play by Sophocles, Talos was "fated to perish." And as Medea guessed, Talos was not immortal—even though *ichor* might have been believed to confer immortality. The myth poses a conundrum: Was Talos a kind of demigod, a "man" encased in bronze, or an animated statue?

In Greek mythology, golden *ichor* instead of red blood circulated in the veins of gods because they were nourished by ambrosia and nectar, which made them ageless and immortal (see chapters 3 and 4 on attempts to appropriate these divine attributes for humans). Immortal gods and goddesses could receive superficial injuries and lose a few drops of *ichor* without dying because their bodies quickly regenerated (Homer *Iliad* 5.364–82; cf. the fate of Prometheus, chapter 3). Even though immortal *ichor* flowed in Talos, Medea reasoned that if she could cause his total exsanguination, he would perish.³⁷

Remarkably, the location of the robot's weak point was biologically determined. According to Hippocratic writings of 410–400 BC on blood-letting procedures, the thick vein on the ankle was the site of choice for the deliberate bleeding of patients, a traditional therapeutic operation. Writing in about 345 BC, Aristotle cited the medical writer Polybus on the major human blood vessels running from the head to the ankle, where surgeons make incisions to drain blood. One characteristic of living creatures noted by Aristotle is that their blood must remain contained in vessels as long as they live; if enough blood is lost, they swoon, but if too much is lost, they die. As early as the fifth century BC, mythographers

and artists placed the nail that sealed Talos’s “blood vessel” at the most logical anatomical place, corresponding to the location of the human vein known to flow most freely, so that when breached by Medea it would cause the robot to bleed out, as a human being would.³⁸

The idea that Medea could destroy with the “evil eye” was an accepted notion in antiquity. According to the physical theories of some natural philosophers and other writers, certain malevolent people could send deadly rays from their eyes like psychic darts into other people, causing them harm, ill fortune, even death. Plutarch, for example, described the phenomenon as a “fiery beam” of malice emanating from an intense gaze. Medea’s eyes are described as dangerous to men throughout the *Argonautica*. With her evil eye, Medea transmitted hellish phantom images (*deikela*) into Talos’s being. Listening to the myth, people in antiquity would have visualized Talos’s eyes as looking quite lifelike, like those of Greek bronze statues they saw: such statues were painted realistically, and their eyes were inlaid with ivory, silver, marble, and gems, with fine silver eyelashes.³⁹ But the evil eye should affect only living things. The idea of transmitting malevolent “rays” to disorient or destroy a machine raises the unsettling/unsettled question of Talos’s true nature. A guardian made of bronze was supposed to have magical protective power. Would a metal object with no feelings be susceptible to the evil eye? That Medea could cast an evil-eye spell to disorient Talos is another indication that he was something more than an insentient metal machine.



Thousands of years before Hollywood’s movie *RoboCop* (1987), about a cyborg police force, and the bionic assassins and bodyguards in the *Terminator* films (1984–2015) and other science fictions about cyborgs capable of deploying lethal force, the ancient Greeks could imagine robotic guardians created by supertechnology that imitated nature, *biotechnē*. Talos, like modern ideas of cyborgs, and like other ancient automata made by divine craft, was envisioned as a hybrid of living and nonliving parts. Further, through myths like that of Talos, ancients could contemplate whether an entity “made, not born” was simply a mindless machine or an autonomous, sentient intelligence. In the Talos myth, the sorceress Medea perceived the issues that have become themes in science fiction

from Mary Shelley's *Frankenstein* (1818) to *Blade Runner* (Ridley Scott, 1982) and *Blade Runner 2049* (Denis Villeneuve, 2017) to *Her* (Spike Jonze, 2013) and *Ex Machina* (Alex Garland, 2014). The Talos myth was an early exploration of the idea that automata might come to desire to be real humans. As we saw, Medea intuited that, like a mortal being, Talos might fear his own death and long for immortality.

The Talos story also showcases how the Greeks envisioned the engineering brilliance of Hephaestus, the divine smith, inventor, and technician. The myth demonstrates that at a very early date, people could conceive the idea of manufacturing a bronze android with encoded instructions to carry out complex activities based on superhuman strength: Talos could recognize and track trespassers; he could find and pick up rocks, then aim and hurl the missiles from afar. He could also crush and burn enemies within reach. Most telling, Talos could be swayed by suggestion, revealing his hybrid living/nonliving nature, the uncanny "in-betweenness" that is a persistent hallmark of automata. The Talos myth embodies age-old questions about what it is to be human and free.⁴⁰

Some of the questions raised by the Talos tale have not escaped modern video game makers. For example, a philosophical narrative puzzle created in 2014 plumbs conundrums of Artificial Intelligence (AI), free will, and "transhumanism," the belief that advanced technology can enhance human physiology, psychology, and intelligence. The game is called *The Talos Principle*. A single player assumes the role of an AI robot that seems to have human-like consciousness and autonomy. Progressing through a complex world littered with classical ruins and relics of a lost modern dystopia, the player reacts to obstacles, clues, and choices to solve metaphysical dilemmas.⁴¹

More than twenty-five hundred years ago, the story of Talos set in motion ancient versions of the knotty questions about how to control automata, foreshadowing modern moral qualms that surround our robot-AI technologies. Some four hundred years ago, in 1596, poet Edmund Spenser employed a Talos-like figure—a mechanical android he named Talus—to address ethical issues of robots in *The Faerie Queene*. Can moral values be mechanized? Can machines understand justice or compassion? In Spenser's allegorical epic poem, the automated squire made of iron was sent to help Sir Artegall, the righteous cavalier, in his quest to serve justice to villains. Invincible and relentless, the Iron Knight



FIG. 1.11. Sir Artegall and his automaton squire, the Iron Knight Talus. Edmund Spenser, *The Faerie Queene* (1596), wood engraving by Agnes Miller Parker, 1953.

triggered by specific situations. But what if the situation shifts or it becomes necessary to interrupt the automatic response? How can humans control, disable, or destroy a powerful, unstoppable machine? How does one incapacitate an automated entity once set on track?

In the ancient myth of Talos, Medea's duel with Talos turned on a twofold approach. Her knowledge of the robot's internal system allowed her to exploit a physical flaw. She also perceived that the android might have evolved human-like "emotions," such as a terror of termination. Armed with these two insights, Medea devised a trick and persuaded Talos to allow her to perform a technological-surgical operation on his body that would in fact annihilate him instead of fulfilling his innate drive or "wish" to go on forever.

The destruction of Talos was not the only time the techno-wizard Medea would wield her knowledge of artificial life to destroy an enemy by promising to cheat death.

Talus takes his job literally. Becoming an inflexible killing machine without mercy, Talus is a symbol of an inhumane, unbending form of justice, with no interest in wrongdoers' extenuating circumstances, motives, or backstories. Concerns about whether automata can be "programmed" with ethical values (to be "artificial moral agents," AMAs, in robotic literature today), or whether automata could have emotions or "intuitions," arose in ancient and medieval myths long before sweeping advances in technology made the questions so urgent.⁴²

It may seem desirable to have a security system that dispatches guardians or agents created by superior intelligence to automatically perform preordained duties

TALOS IN THE MODERN WORLD

The solitary conduit carrying the mysterious force that animated Talos has been compared to an alternating electrical current. Bronze, being mostly copper, does have high electrical conductivity, but this fact was unknown in antiquity (although bronze colossi would have acted as lightning rods). In 2017, a writer for *Popular Mechanics* compared Talos's ichor to the blue liquid that bleeds from imaginary humanoid robots in the popular television series *HUMANS* (their animating fluid is described as a "synthetic magneto hydrodynamic conductant"). The ancient image of Talos's solitary conduit of mysterious ichor fluid may reflect something akin to what cognitive scientists call "intuitive theories" of children and adults about physics and biology. Even among people today who understand that an electrical circuit requires two wires, a mental picture persists of an empowering "juice" flowing through a single cable. Our "pre-scientific" intuitive vision coexists with modern scientific knowledge.⁴³

In 1958, the author of a brief history of robots in *Popular Electronics* remarked on Talos's "single 'vein' running from his neck to his ankle, stoppered somewhere in his foot by a large bronze pin." Viewed in "modern terms," the author mused, this conduit "could have been his main power cable and the pin his fuse." Writing at the height of the Cold War, the author went on to declare that Talos was an ancient "Weapons Alert System and Guided Missile in one package!"⁴⁴

Notably, that same year, 1958, the largest surface-to-air guided missile became

operational. Fittingly, given Talos's role as an automated adjunct of the superior Minoan navy, the new US naval weapon system was named Talos. When development began in 1947, the military planners sought "an appropriate name." They found it in Thomas Bulfinch's popular *Age of Fable* (1855). According to the official history of the missile, Talos "watched over and guarded the island of Crete. He was made of brass and was reputed to fly through the air at such terrific speed that he became red hot. His method of dealing with his enemies was to clasp them tightly to his breast, turning them to cinders at once." In this modern telling, Talos was airborne, recalling the winged images of Talos on the coins of Phaistos, and he was heated by intense friction, but these details are not found in any Bulfinch edition or ancient text.



FIG. 1.12. Talos RIM-8 missile, 1950s. US Army/Navy archives.

Talos was “approved as the name for the new ramjet missile” in 1948. The Talos guided missiles patrolled the seas mounted on large naval carriers, ready to launch their warheads at enemies. Paralleling the duties of the mythical bronze robot on Crete, the Talos missiles served as a frontline defense, with a range of two hundred miles and a speed of Mach 2.5 (almost 2,000 mph, twelve times the estimated speed of bronze Talos). Like Talos ceaselessly circling his territory, spotting and tracking invaders, and then lobbing rocks to destroy foes, the Talos defense system was automatically directed, but it was partly autonomous at closer range. The Talos guided missiles “rode” a radar beam most of the way to the vicinity of the target but then homed in on the target “semiactively.”⁴⁵

Modern military fascination with the myth of the great bronze robot continued. In 2013, inspired by the age-old science fiction of an invincible warrior made of the strongest materials and most advanced technology, the US Special Operations Command (SOCOM) and Defense Advanced Research Projects Agency

(DARPA) initiated a project to create a futuristic, robotic exoskeleton suit of armor for special operations (special ops) soldiers, something akin to the weaponized suit worn by the superhero in the film *Iron Man* (2008). Human enhancement and augmenting mortal powers are very ancient ideas, as we’ll see in chapter 3. The idea for the high-tech armored suit arose from a commander’s desire to protect his men in unconventional battle situations in Afghanistan and Iraq. With the Greek myth of Talos in mind, SOCOM devised the name Tactical Assault Light Operator Suit in order to render the acronym TALOS. The full-body form-fitting powered armor, intended to provide superhuman strength, hypersensory awareness, and ballistic protection, includes embedded computers, biosensors, enhanced vision and audio capabilities, solar panels, and features that capture kinetic energy. The plans for TALOS even call for an electronically activated “liquid body armor” system developed by MIT, which cannot help but recall the ichor of the immortal gods. As of this writing in 2018, TALOS is still unrealized.⁴⁶

FIG. 1.13. TALOS, Tactical Assault Light Operator Suit, soldier’s exoskeleton uniform proposal, US SOCOM.

