



NASA's first software engineer: Margaret Hamilton

Fonte: <https://youtu.be/kYCZPXSvVOQ>



English Transcript	Tradução
NASA's First Software Engineer: Margaret Hamilton	A Primeira Engenheira de Software da NASA: Margaret Hamilton
At roughly 4:00 p.m. on July 20th, 1969, mankind was just minutes away from landing on the surface of the Moon. But before the astronauts began their final descent, an emergency alarm lit up. Something was overloading the computer and threatened to abort the landing.	Por volta das 16h do dia 20 de julho de 1969, a humanidade estava a poucos minutos de pousar na superfície da Lua. Mas, antes de os astronautas iniciarem a descida final, um alarme de emergência acendeu. Algo estava sobrecarregando o computador e ameaçava abortar o pouso.
Back on Earth, Margaret Hamilton held her breath. She'd led the team developing the pioneering in-flight software, so she knew this mission had no room for error. But the nature of this last-second emergency would soon prove her software was working exactly as planned.	Na Terra, Margaret Hamilton prendeu a respiração. Ela havia liderado a equipe que desenvolveu o pioneiro software de voo, então sabia que aquela missão não permitia erros. Mas a natureza dessa emergência de última hora logo provaria que seu software estava funcionando exatamente como planejado.
Born 33 years earlier in Paoli, Indiana, Hamilton had always been inquisitive. In college, she studied mathematics and philosophy before taking a research position at the Massachusetts Institute of Technology to pay for grad school. Here she encountered her first computer while developing software to support research into the new field of chaos theory. Next, at MIT Lincoln Laboratory, Hamilton developed software for America's first air defense system to search for enemy aircraft.	Nascida 33 anos antes em Paoli, Indiana, Hamilton sempre foi curiosa. Na faculdade, estudou matemática e filosofia antes de assumir um cargo de pesquisa no MIT para pagar a pós-graduação. Foi lá que ela encontrou seu primeiro computador, enquanto desenvolvia software para apoiar pesquisas no novo campo da teoria do caos. Em seguida, no Laboratório Lincoln do MIT, Hamilton desenvolveu software para o primeiro sistema de defesa aérea da América para buscar aeronaves inimigas.



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<p>But when she heard the renowned engineer Charles Draper was looking for help sending mankind to the moon, she immediately joined his team. NASA looked to Draper and his group of 400 engineers to invent the first compact digital flight computer: the Apollo Guidance Computer (AGC). Using input from astronauts, this device would be responsible for guiding, navigating, and controlling the spacecraft. At a time when unreliable computers filled entire rooms, the AGC needed to operate without any errors and fit in one cubic foot of space.</p>	<p>Mas quando soube que o renomado engenheiro Charles Draper estava procurando ajuda para enviar o homem à Lua, ela imediatamente se juntou à equipe. A NASA contava com Draper e seu grupo de 400 engenheiros para inventar o primeiro computador de voo digital compacto: o Apollo Guidance Computer (AGC). Usando comandos dos astronautas, este dispositivo seria responsável por guiar, navegar e controlar a espaçonave. Em uma época em que computadores pouco confiáveis ocupavam salas inteiras, o AGC precisava operar sem erros e caber em um pé cúbico de espaço.</p>
<p>Draper divided the lab into two teams: one for designing hardware and one for developing software. Hamilton led the team that built the onboard flight software for both the command and lunar modules. This work, for which she coined the term "software engineering," was incredibly high stakes. Human lives were on the line, so every program had to be perfect.</p>	<p>Draper dividiu o laboratório em duas equipes: uma para projetar o hardware e outra para desenvolver o software. Hamilton liderou a equipe que construiu o software de voo a bordo, tanto para o módulo de comando quanto para o lunar. Esse trabalho, para o qual ela cunhou o termo "engenharia de software", era de altíssimo risco. Vidas humanas estavam em jogo, então cada programa tinha que ser perfeito.</p>
<p>Margaret's software needed to quickly detect unexpected errors and recover from them in real time. But this kind of adaptable program was difficult to build since early software could only process jobs in a predetermined order. To solve this problem, Margaret designed her program to be asynchronous, meaning the software's more important jobs would interrupt less important ones. Her team assigned every task a unique priority to ensure that each job occurred in the correct order and at the right time, regardless of any surprises.</p>	<p>O software de Margaret precisava detectar rapidamente erros inesperados e se recuperar deles em tempo real. Mas esse tipo de programa adaptável era difícil de construir, já que os softwares antigos só podiam processar tarefas em uma ordem predeterminada. Para resolver esse problema, Margaret projetou seu programa para ser assíncrono, o que significa que as tarefas mais importantes do software interromperiam as menos importantes. Sua equipe atribuiu a cada tarefa uma prioridade única para garantir que cada trabalho ocorresse na ordem correta e no momento certo, independentemente de surpresas.</p>
<p>After this breakthrough, Margaret realized her software could help the astronauts work in an asynchronous environment as well. She designed priority displays that would interrupt astronauts' regularly scheduled tasks to warn them of emergencies. The astronaut could then communicate with Mission Control to determine the best path forward. This marked the first time flight software communicated directly and asynchronously with a pilot.</p>	<p>Após esse avanço, Margaret percebeu que seu software também poderia ajudar os astronautas a trabalhar em um ambiente assíncrono. Ela projetou telas de prioridade que interrompiam as tarefas regulares dos astronautas para alertá-los sobre emergências. O astronauta poderia então se comunicar com o Controle da Missão para determinar o melhor caminho a seguir. Isso marcou a primeira vez que um software de voo se comunicou direta e assincronamente com um piloto.</p>
<p>It was these fail-safes that triggered the alarms just before the lunar landing. Buzz Aldrin quickly realized his mistake: he'd inadvertently flipped the rendezvous radar switch. This radar would be essential on their journey home, but here it was using up vital computational resources. Fortunately, the Apollo Guidance Computer was well equipped to manage this. During the</p>	<p>Foram esses mecanismos de segurança que dispararam os alarmes pouco antes do pouso lunar. Buzz Aldrin percebeu rapidamente seu erro: ele havia acionado inadvertidamente o interruptor do radar de encontro. Esse radar seria essencial na jornada de volta para casa, mas ali estava consumindo recursos computacionais vitais. Felizmente, o computador da Apollo estava bem equipado para gerenciar isso. Durante a sobrecarga, os</p>



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overload, the software restart programs allowed only the highest priority jobs to be processed, including the programs necessary for landing.	programas de reinicialização do software permitiram que apenas as tarefas de maior prioridade fossem processadas, incluindo os programas necessários para o pouso.
The priority displays gave the astronauts a choice: to land or not to land. With minutes to spare, Mission Control gave the order. The Apollo 11 landing was about the astronauts, mission control, software, and hardware all working together as an integrated system of systems.	As telas de prioridade deram aos astronautas uma escolha: pousar ou não pousar. Com minutos de sobra, o Controle da Missão deu a ordem. O pouso da Apollo 11 foi sobre astronautas, controle de missão, software e hardware, todos trabalhando juntos como um sistema integrado de sistemas.
Hamilton's contributions were essential to the work of engineers and scientists inspired by President John F. Kennedy's goal to reach the moon, and her life-saving work went far beyond Apollo 11. No bugs were ever found in the in-flight software for any crewed Apollo missions.	As contribuições de Hamilton foram essenciais para o trabalho de engenheiros e cientistas inspirados pelo objetivo do presidente John F. Kennedy de chegar à Lua, e seu trabalho salvador de vidas foi muito além da Apollo 11. Nenhum erro (*bug*) jamais foi encontrado no software de voo em qualquer missão Apollo tripulada.
After her work on Apollo, Hamilton founded a company that uses its unique Universal Systems Language to create breakthroughs for systems and software. In 2003, NASA honored her achievements with the largest financial award they'd ever given to an individual. And 47 years after her software first guided astronauts to the moon, Hamilton was awarded the Presidential Medal of Freedom for changing the way we think about technology.	Após seu trabalho na Apollo, Hamilton fundou uma empresa que usa sua linguagem de sistemas universal para criar avanços em sistemas e software. Em 2003, a NASA homenageou suas conquistas com o maior prêmio financeiro que já haviam dado a um indivíduo. E 47 anos depois que seu software guiou os astronautas à Lua pela primeira vez, Hamilton recebeu a Medalha Presidencial da Liberdade por mudar a forma como pensamos sobre a tecnologia.



Contagem de palavras

A tabela abaixo exhibe as palavras encontradas neste vídeo, bem como o número de vezes em que aparecem.

Veja também: [Para que serve esta tabela?](#)

Freq.	Palavra	Freq.	Palavra	Freq.	Palavra
49	the	26	to	18	software
15	and	14	for	12	of
11	was	11	in	10	this
10	her	8	would	8	she
8	hamilton	7	astronauts	7	a
6	on	6	first	6	apollo
5	work	5	that	5	margaret
5	landing	5	flight	5	computer
5	but	5	be	5	at
4	with	4	time	4	team
4	priority	4	moon	4	mission
4	an	3	were	3	systems
3	program	3	order	3	one
3	nasa	3	jobs	3	his
3	had	3	from	3	draper
3	developing	3	could	3	control
3	before	3	as	3	any
3	after	2	years	2	working
2	when	2	well	2	using
2	up	2	unique	2	them
2	their	2	technology	2	system
2	so	2	research	2	realized
2	radar	2	quickly	2	programs
2	only	2	no	2	needed
2	minutes	2	mankind	2	lunar
2	led	2	land	2	just
2	it	2	into	2	interrupt
2	important	2	here	2	help
2	hardware	2	guidance	2	gave
2	every	2	ever	2	essential
2	errors	2	engineers	2	engineer
2	emergency	2	displays	2	designed
2	asynchronous	2	agc	2	about
1	without	1	while	1	which
1	went	1	we	1	way
1	warn	1	vital	1	uses



Freq.	Palavra	Freq.	Palavra	Freq.	Palavra
1	unreliable	1	universal	1	unexpected
1	two	1	triggered	1	together
1	threatened	1	think	1	they
1	these	1	theory	1	then
1	th	1	term	1	teams
1	tasks	1	task	1	taking
1	switch	1	surprises	1	surface
1	support	1	studied	1	stakes
1	spare	1	spacecraft	1	space
1	soon	1	something	1	solve
1	since	1	sending	1	second
1	search	1	scientists	1	school
1	scheduled	1	saving	1	safes
1	roughly	1	rooms	1	room
1	right	1	restart	1	responsible
1	resources	1	renowned	1	rendezvous
1	regularly	1	regardless	1	recover
1	real	1	reach	1	prove
1	processed	1	process	1	problem
1	presidential	1	president	1	predetermined
1	position	1	planned	1	pioneering
1	pilot	1	philosophy	1	perfect
1	pay	1	path	1	paoli
1	p	1	overloading	1	overload
1	or	1	operate	1	ones
1	onboard	1	occurred	1	not
1	next	1	new	1	necessary
1	navigating	1	nature	1	more
1	modules	1	mit	1	mistake
1	missions	1	medal	1	meaning
1	mathematics	1	massachusetts	1	marked
1	manage	1	m	1	looking
1	looked	1	lives	1	lit
1	line	1	lincoln	1	life
1	less	1	last	1	largest
1	language	1	laboratory	1	lab
1	knew	1	kind	1	kennedy
1	july	1	journey	1	joined
1	john	1	job	1	its
1	invent	1	integrated	1	institute
1	inspired	1	inquisitive	1	input



Freq.	Palavra	Freq.	Palavra	Freq.	Palavra
1	individual	1	indiana	1	incredibly
1	including	1	inadvertently	1	immediately
1	human	1	honored	1	home
1	highest	1	high	1	held
1	heard	1	he	1	guiding
1	guided	1	group	1	grad
1	goal	1	given	1	freedom
1	founded	1	found	1	forward
1	fortunately	1	foot	1	flipped
1	fit	1	financial	1	final
1	filled	1	field	1	far
1	fail	1	f	1	exactly
1	error	1	equipped	1	environment
1	entire	1	ensure	1	engineering
1	enemy	1	encountered	1	emergencies
1	earth	1	early	1	earlier
1	each	1	during	1	divided
1	directly	1	digital	1	difficult
1	device	1	developed	1	determine
1	detect	1	designing	1	descent
1	defense	1	cubic	1	crewed
1	create	1	correct	1	controlling
1	contributions	1	computers	1	computational
1	company	1	compact	1	communicated
1	communicate	1	command	1	college
1	coined	1	choice	1	charles
1	chaos	1	changing	1	by
1	buzz	1	built	1	build
1	bugs	1	breath	1	breakthroughs
1	breakthrough	1	both	1	born
1	beyond	1	best	1	began
1	been	1	back	1	away
1	awarded	1	award	1	asynchronously
1	astronaut	1	assigned	1	america
1	always	1	allowed	1	all
1	aldrin	1	alarms	1	alarm
1	aircraft	1	air	1	adaptable
1	achievements	1	abort		