Key Student Learnings:

Secondary Tour Objective:

Students will be able to learn how computer science, engineering, and people work together to fulfil customer orders at Amazon.

Students will also be able to meet software, hardware, and system engineers to learn about how their jobs make this technology possible.

Key Vocabulary:

The following vocabulary will be introduced in audio and visual format during the tour:

- **Hardware:** the physical parts of a computer or device (stuff you can touch)
- **Software:** also know as code or programme, the instructions that tell the computer or robot how to work and what to do
- **System:** a group of devices (hardware and software) that work together to accomplish a task.
- **Algorithm:** a set of step-by-step instructions or rules that a computer or robot follows to perform a task
- **Database:** a place where data is organised and stored
- **Sensor:** a device that takes in information from its environment and responds

Key Learnings by Tour Stop:

Stop:	Interactive Questions:	Learnings and FC Context Summary:
Welcome	1) Right now, how interested are you in career opportunities in computer science and technology? 2) What do you already know about Amazon, robots, or computer science? Open response answers or turn and talk 3) What was the fastest Amazon has ever delivered a customer order? a. Under 3 minutes b. **Under 30 minutes** c. About 1 hour d. About 3 hours 4)The robots used to carry the pods are an example of _____ a. **Hardware** b. Software c. Algorithm	The tour guide will give an overview of the tour and set expectations. Hardware is the physical parts of a computer or device – it's the stuff you can touch, like computers, scanners, robots, and machines. Software is the code or program – the instructions that tell a computer or robot how to work and what to do. When hardware and software work together to accomplish a task, it is called a system. The hardware and software at the Pick, Pack, and Ship sites work together to deliver orders safely and correctly to Amazon customers. Watch this tour stop in Video 1, Video 2, and Video 3.

Stop:	Interactive Questions:	Learnings and FC Context Summary:
	d. System 5. The robots know where to go because ___ programs its path using code.	
Pick	6. How does Amazon organise and store items in each fulfilment centre? a. Alphabetically by name b. By their purpose (cleaning supplies, art suppliers, sports items etc) c. By their colour (orange items, green items, blue items) d. **Randomly – no organisation method** 7. After the item is placed in a tote, the picker taps a sensor. The sensor is an example of _____ a. Software b. Algorithm c. **Hardware** d. System 8. Hardware, software, and people work together at a pack station to form a _____ a. Sensor b. **System** c. Database d. Algorithm	Algorithms are sets of instructions or rules that a computer follows to perform a task. Algorithms decide what Fulfilment Centre should process your order. The algorithm first looks at which Fulfilment Centres have your item(s) and then selects one that is closest. Once an order goes to a Fulfilment Centre with the items in stock, the computer needs to determine where the item is stored within the huge fulfilment centre. Inside the FC< items are stored in tall, moveable shelves called pods. Each pod can be moved by a robot (called a drive unit) that is programmed by a software program and has sensors on it that can detect and response to the robot's environment. The robotic drive unit uses sensors and unique QR codes on the floor to move around, avoid obstacles like other robots, fallen items or people, and deliver the correct pods to the correct place. If there is ever a problem with the hardware (robots) or software (algorithm), there is a team that can go onto the FC floor and help troubleshoot, or solve, the problem. Items in a Fulfilment Centre are stored randomly so items are spread out across a big area, and a robot can efficiently choose a path to the nearest object without running into it or getting stuck around other robots. An algorithm calculates the closest pod with the correct item and then tells the robot to take it to the human picker. When the robot delivers the correct pod(s) to a picking station, an associate will pick the item from the pod and send it for packing. Watch this stop in Video 3, Video 4, and Video 5.
Pack	9. How does a packer choose the right sized box? a. Years of training with the experts at our Packing Dojo b. **Following on screen instructions based on previously recorded item measurements** c. Users rulers and tape measures on each item and working out the math for each order	When an item arrives at Amazon to be sold, we record many pieces of data, or information, about it like its height, width, and weight. These facts are stored in a database. A database is a place where data is organised and stored, like on a computer or in the cloud. Amazon ships a lot of items. We try to be as efficient as possible and use as little time, electricity, cardboard, fuel etc to deliver this item.

Stop:	Interactive Questions:	Learnings and FC Context Summary:
	d. Pick the box which simply looks big enough 10. ____ tells a packer exactly which box to use for the items they are packing a. Hardware b. Sensors c. Robots d. **Software** 11) The tape dispenser that spits out the exactly the right amount of tape is an example of ____ a. **Hardware** b. Sensors c. Robots d. Software	Efficiency is the ability to accomplish something with the least waste of time, energy, effort, or material. Amazon's Sustainability team works to make sure Amazon's shipping and delivery process is as efficient as possible. How do we practice efficiency when choosing a box to ship an item? We need to pick the smallest box possible whilst also protecting the items. When an item is ordered, a computer program finds the item's dimensions and weight from the database and automatically calculates (using an algorithm!) which box will be most efficient to use (even when combined with other items!). Watch this stop in Video 5, Video 6, and Video 7.
Ship	12) How does Amazon check that an order is correct if the box is already sealed? a. **Weighs the item as it goes over the conveyor belt** b. Uses an X-ray to check the item inside is correct c. Use the robot arm to rattle the box and microphones to listen for the correct sound d. It doesn't perform any more checks, you're trying to trick us. 13) The SLAM station uses an algorithm to see if an order is correct. The algorithm is an example of ____ a. Hardware b. **Software** c. Sensors d. A database 14. The SLAM algorithm looks up the expected weight of the item from ___ a. Hardware b. Software c. Sensors d. **A database**	After the order is packaged in an efficient box, the order is double-checked. At this station, the customer address label is applied and a sensor weighs the box. The system references the database to calculate how much the item(s) in the box should weight and compares that to how much it actually weighs. An algorithm decides if the weight is accurate or not. If it is not accurate, the box is automatically pulled off, inspected, and corrected by an associate. If it is correct, it heads onto shipping. At the ship station, more data is analysed by computer programs to choose the most efficient truck and route for shipping to the customer's home or business! As the packages move down the conveyor belt towards the trucks, the computer software triggers hardware to push the packages down a chute, or a slide, to its correct truck. Watch this stop in Video 7, Video 8, and Video 9.
Careers	15. Which career interests you most? a. Designing and building robots (Hardware Engineer)	Students meet three Amazon Robotics employees. One from Hardware, Software, and Solutions. Students learn how Hardware and Software must

Stop:	Interactive Questions:	Learnings and FC Context Summary:
	b. Coding the robots and computer systems (Software Engineer) c. Designing how the whole process works (Solutions / Systems Engineer)	work together to make the best Amazon Robotics Solution Possible. Watch this stop in Video 9 and Video 10.
Survey	At the end of the tour, students will be asking the following questions in Kahoot! Amazon Future Engineer uses these responses to help improve future Career Tours. 16) What was your favourite part of the tour? 17) Overall, rate your experience on a scale of 1-5 18) After this tour, how interested are you in career opportunities in computer science and technology? 19) On a scale of 0-10, how likely are you to recommend this tour to a friend or peer?	

After the tour:

- Test your students' vocabulary. Assign this Kahoot! to students to test their new computer science vocabulary!
- Lead a discussion. Use these discussion questions to debrief with your students after the tour.
- Celebrate: Print and distribute student certificates for completing the tour!
- Dissect the SLAM Algorithm: The SLAM station checks each box before it heads to shipping using a complicated algorithm. Can your students figure it out? Dissect the SLAM using this worksheet. Great for advanced learners.

Standards Alignment:

The Amazon Future Engineer Kahoot! FC Tour is aligned to a variety of educational standards:

- National Curriculum for England
- Curriculum for Wales
- Northern Ireland Curriculum
- Scotland's Curriculum for Excellence

National Curriculum for England (See the curriculum here)

The following statements from the Programmes of Study are fully or partially addressed during the tour:

Key Stage 2

Pupils should be taught to:

- Use logical reasoning to explain how some simple algorithms work and to detect and correct errors in algorithms and programs
- Use sequence, selection, and repetition in programs; work with variables and various forms of input output.

Key Stage 4

All pupils should be taught to:

- Develop their capability, creativity and knowledge in computer science, digital media and information technology
- Develop and apply their analytical, problem-solving, design, and computational thinking skills.

- Understand computer networks ... can provide multiple services... and the opportunities they offer for communication and collaboration.

Key Stage 3

Pupils should be taught to:

- Design, use and evaluate computational abstractions that model the state and behaviour of real-world problems and physical systems.
- Use logical reasoning to compare the utility of alternative algorithms for the same problem.
- Understand how the hardware and software components that make up computer systems, and how they communicate with one another and with other systems.

Key Stage 5

The DfE's guidance on Computer Science content for Post 16 courses specifies that:

- All specifications in computer science must build on the knowledge, understanding and skills established at key stage 4 and encourage students to develop a broad range of the knowledge, understanding and skills of computing, as a basis for progression into further learning and/or employment.

Northern Ireland Curriculum (see the curriculum here)

The following statements from the Programmes of Study are fully or partially addressed during the tour:

Key Stages 1,2 & 3

Students build towards the following statements based on their age and ability. Pupils can:

Explore

- Access, select, interpret and research information from safe and reliable sources;
- Investigate, make predictions and solve problems through interaction with digital tools.

Express

- Create, develop, present and publish ideas and information responsibly using a range of digital media and manipulate a range of assets to produce multimedia products.

Exchange

- Communicate safely and responsibly using a range of contemporary digital methods and tools,

Exhibit

- Manage and present their stored work and showcase their learning across the curriculum, using ICT safely and responsibly.

Key Stage 4 – GCSE Digital Technology

Students will cover some of the content for each of the following topics:

Unit 1 - Digital Technology

- Software, database applications, computer hardware, network technologies, network security, cloud technology, moral and ethical considerations, health and safety and using digital applications.

Unit 4 – Digital Development Concepts

- Digital design principles, programming constructs, error handling techniques, test plans and testing.

exchanging, sharing, collaborating and developing ideas digitally.

Evaluate

- Talk about, review and make improvements to work, reflecting on the process and outcome and consider the sources and resources used, including safety, reliability and acceptability.

Unit 5 – Digital Development Practice

- Designing solutions, building solutions, testing solutions and evaluating the solution.

Curriculum for Wales (see the guidance here)

The following statements are from the section entitled: **Computation is the foundation for our digital world within the wider Science and Technology Area of Learning and Experience** are fully or partially addressed during the tour (although aspects of other parts of the curriculum may also be addressed):

Progression Step 1

- I can identify, follow and begin to create sequences and patterns in everyday activities
- I am beginning to follow a sequence of instructions.
- I can experiment with and identify uses of a range of computing technology in the world around me.

Progress Step 2

- I can use computational thinking techniques, through unplugged or offline activities.
- I can create simple algorithms and am beginning to explain errors.
- I can follow algorithms to determine their purpose and predict outcomes.

Progress Step 3

- I can explain and debug algorithms.
- I can identify, define and decompose problems, choose appropriate constructs and express solutions in a variety of environments.

Progression Step 3 (continued)

- I can use conditional statements to add control and decision-making to algorithms
- I can identify repeating patterns and use loops to make my algorithms more concise.
- I can use sensors and actuators in systems that gather and process data about the systems' environment.
- I can explain how digital devices can be interconnected locally and globally.

Progress Step 4

- I can decompress given problems and select appropriate constructs to express solutions in a variety of environments.
- I can explain how systems communicate, in order to design a network.

Progress Step 5

- I can identify, define and decompose problems, choose appropriate constructs and express solutions in a variety of environments.

Scotland's Curriculum for Excellence and Beyond (See the guidance here)

The following statements from the Technologies Curriculum Area are fully or partially addressed during the tour:

Curriculum for Excellence

Digital Literacy

- Using digital products and services in a variety of contexts to achieve a purposeful outcome.

Technological Development in Society and Business

- Awareness of technological developments (Past, Present and Future), including how they work.
- Impact, contribution, and relationship of technologies on business, the economy, politics, and the environment.

Computing Science

- Understanding the world through computational thinking
- Understanding and analysing computing technology
- Designing, building and testing computing solutions

National 5 Computer Science Specification

Software design and development

- Development methodologies, Analysis, Design, Implementation, Testing and Evaluation.

Database design and development

- Design and implementation

Higher Computing Science Specification

Software design and development

- Development methodologies, Analysis, Design, Implementation, Testing and Evaluation.

Computer Systems

- Computer Structure

Advanced Higher Computing Science Specification

Software design and development

- Development methodologies, Analysis, Design, Implementation, Testing and Evaluation.