

French Fast Food Takeaway

Anna Kochan

The French army has just completed full acceptance tests of a F25 million robotized line for assembling and packing meals for its troops operating in trouble spots around the world. Incorporating nine AdeptOne Scara robots, some equipped with Adept AGS vision, and four ABB IRB 6000 robots, the line is intended to produce military rations at a rate of 24 per minute, and to provide a total output of 2 million per year – and more if the demand arises.

Project management and integration activities were carried out by ABB Robotique (France) whose specialist team in robotic packaging applications was set up in Troyes in February 1992 following ABB's takeover of the French systems integrator Astrobotic. The Troyes team, which now numbers 35, is becoming ABB's centre of expertise in packaging for the world market.

The new robot line is just one part of a F60 million investment undertaken by the French army to create a single facility for meals packaging. It has also constructed a brand new building and installed a F6 million modern computerized storage system. The payback period on the investment is expected to be seven years.

Based in Angers in South-West France, the new facility employs 30 people and replaces two operator-intensive units employing 70 altogether, says Colonel Hugues Keller, director of the establishment. It provides a number of improvements particularly concerning the work environment. "It was really archaic in the past", says Colonel Keller. "The manual work was not stressful physically but was painful intellectually, for the operators. We could do better."

In addition, Colonel Keller hopes, the state-of-the-art plant will be able to cope with the fluctuations in the army's needs. "We will be able to run the production equipment more or less intensively, depending on the situation at any one time." It will, for example, enable the army to respond quickly to emergencies. "It is a self-contained meal pack that is easily transportable and distributable and that provides the nourishment a person needs for any 24-hour period." As such, it could be called on in times of crisis, of either a military or civil nature, where large number of people have to be moved quickly and emergency catering arrangements have not yet been set up.

Each meal pack is composed of about 18 different items, including sachets of soup powder and salt-and-pepper, blister packs of water purification tablets, tins containing cooked food and cheese, materials for reheating meals, chocolate, confectionery and chewing gum, and paper handkerchiefs. Each has to be separately positioned in a cardboard box measuring 30.3cm x 15.6cm x 6.9cm to take up a minimum of space.

At the first station in the ABB Robotique line, a special machine forms flat pre-cut cardboard sheets into boxes and transfers them on to the conveyor which delivers them to a succession of Adept robot packaging



The fully packaged ration before being closed and sealed



A line of nine AdeptOne robots fill the ration boxes, two products per robot

stations where the different items are placed in the box, two by each robot.

Packaging the components into the boxes may not be a robotic application that demands extremely high precision but three factors are key. First is the space aspect: components must be positioned exactly in the box so that they will all fit in and the box will eventually close. Second is the different nature of the components which implies different handling for each. Finally, there is the need for flexibility. The army is likely to use several suppliers for the same constituent but different suppliers are unlikely to provide the same element in exactly the same form. For example, no standard yet exists for the shape and size of a sachet containing chewing gum pieces.

The more substantial items in the meal pack are loaded at the first three robotic stations in the new line. These are components such as flat tins and large oblong packs of dry crackers which have to be arranged in the bottom of the carton so that the other smaller and more fragile elements can be put on top at the subsequent six stations.

Each of the first three Adept robots handles two parts and is thus equipped with a double-gripper. These grippers either grasp the part with a pair of



Each Adept robot is equipped with end-effectors capable of handling two different items simultaneously

“fingers” or hold it with vacuum, depending on the nature of the element and its packaging. The tins, for example, are picked up and moved by suction, but the plastic-wrapped crackers are grasped by a pair of “fingers”. The design of the end-effectors enables the robot to perform the packaging operation using two movements for picking up the parts followed by a single movement for placing them in the box.

An ABB IRB 6000 depalletizing robot ensures a constant supply of provisions to each of these first three packing stations. This large robot is equipped with a massive tool fitted with a quantity of suction cups which enables it to transfer products, a complete layer at a time, from the carton in which they are supplied, to a conveyor system. The products are then channelled one-by-one to the pick-up position for the Adept packing robot. Three such depalletizing robots, each handling two different products, service the first three packing stations.

Following the assembly of the large components into the carton by the first three Adept robots, the subsequent six packing stations handle all the small, sometimes flimsy items. These are fed to the packing line by a separate combination of a hopper and a vibratory bowl feeder for each part. In order to maintain the flexibility of the feeding mechanism, the bowl feeders are not extensively tooled mechanically but vision is employed where necessary. Apart from one robot which is just responsible for adding a batch of four wrapped sugar lumps, the five other Adept robots are each equipped with a double gripper to enable them to handle two different components exactly as the first three do.

Because of the need to position and orientate a number of the small light items precisely for the pick-up operation, four of the last five Adept robots are equipped with industrial vision. When a part exits from the bowl



Four of the Adept robot stations use Adept AGS vision to help locate parts and orientate grippers for precise pick-up

feeder at these stations, a conveyor illuminated from underneath advances the part until it arrives within the field of vision of an overhead camera. The role of the vision system is to indicate to the robot the position of the centre of gravity of the part and also its orientation so that the robot can pick it up and load it correctly to the carton. Also, the industrial vision system can identify any parts whose geometry differs significantly from the one that is programmed, enabling such parts to be rejected.

Once completely filled, the boxes continue along the same conveyor and are transferred to machines which close and seal them, enclose them in a plastic film, and group them in batches of 12 in large boxes. These large boxes finally arrive at a palletizing station where an IRB 6000 loads them onto pallets, in three layers of seven boxes each. As well as palletizing freshly-packed rations ready for storage, this



Three ABB IRB 6000 robots transfer products, one layer at a time, directly from their cardboard boxes to the handling system feeding parts to the first three Adept robots

robot also prepares pallets containing seven different ration menus, which is the usual format for shipment.

The army currently prepares 14 different menus for its troops, though 14 elements are common to all. It is the tinned hors-d’oeuvre, the two cooked meals and the flavour of the soup powder which varies. As the form of all the constituents is the same, irrespective of its flavour, changeover from packing one menu to another takes only about 15 minutes. It is too early to say how often a changeover will be effected though probably not more than once a day, or once every two days, says Colonel Keller.

The computerized store for all components and palletized rations was supplied by Fenwick-Linde. Covering an area of 4,000 m² and extending to a height of 12m, the store is capable of stocking up to 6,200 pallets. Four fork-lift trucks transfer ration components and packaging materials, as well as completed pallets, between the storage area and the relevant packaging stations, and two-manned wire-guided stacker cranes handle the placement of the pallets in the high-rise store.

Six PCs linked by an Ethernet LAN and supervised by a Nobel computer manage the stocks. As each pallet arrives from the outside supplier or from the packaging line, it is given a bar code. On board each truck and crane is a terminal which is in real-time radio communication with the computer system and which indicates on a screen the tasks the drivers are to perform. Special bar code reading devices are provided to the drivers which can function at a distance of 2.5m from the code.



Filled and boxed rations are palletized by a fourth ABB IRB 6000 robot

As the new packaging facility at Angers builds up to full speed, Colonel Keller is hoping that, at F38 (about £4) per meal, other armies in the world, and perhaps even civil organizations, could become customers.

