Space

Space suits are already complicated textile, fluidic and electronic systems. They need to protect the astronaut against the hazards of space plus control their temperature, provide their respiratory gases, remove their excretions, enable their communications and monitor their health.

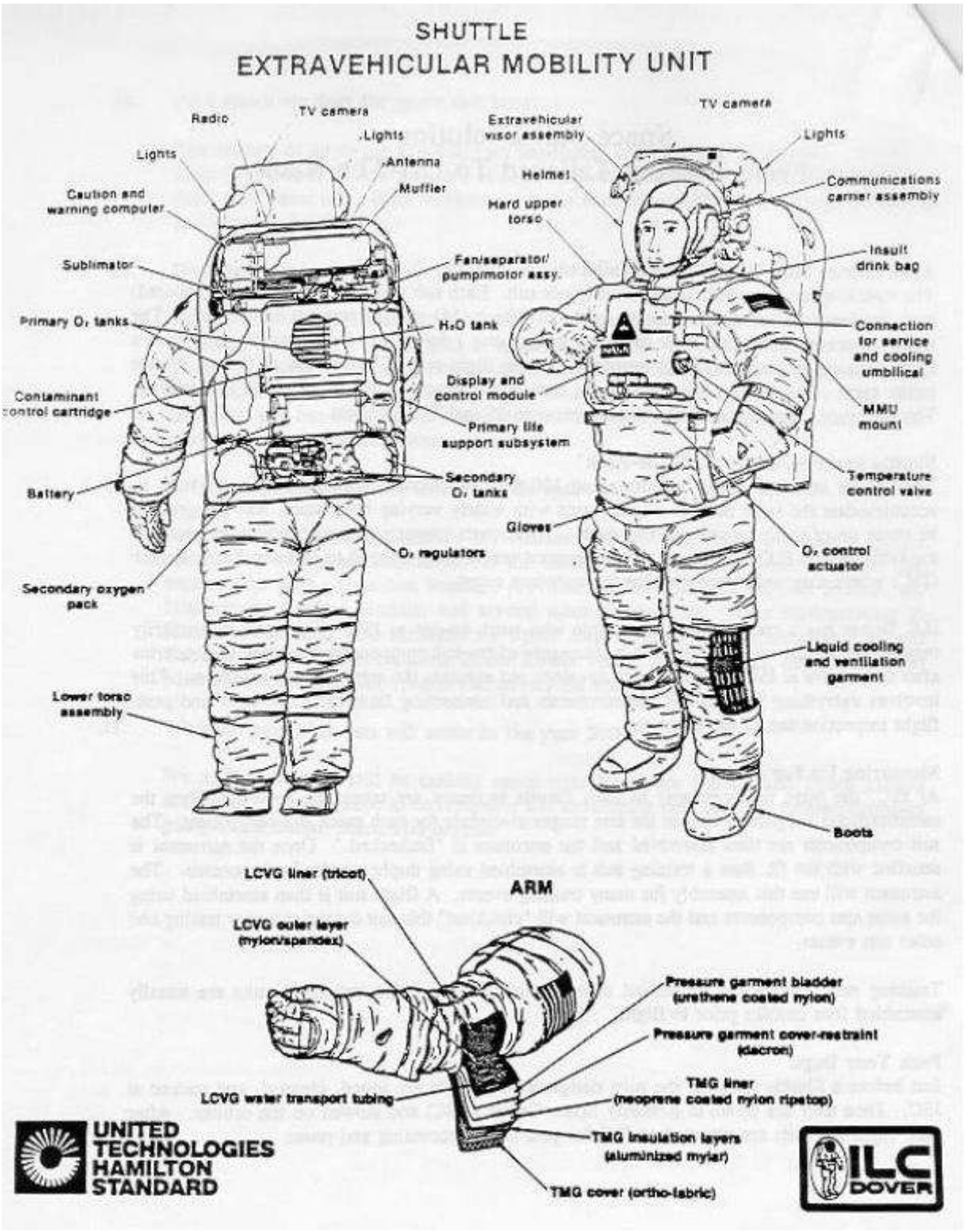
Some useful background information on the history of spacesuits - the first complex smart clothing:

http://www.fi.edu/pieces/hiley/history.htm
http://inventors.about.com/od/sstartinventions/a/spacesuits.htm

Space Suit Requirements include:

- UV, cosmic and X-ray radiation protection
- Micrometeorite protection
- Temperature protection,
- Control Pressure (vacuum) protection
- Body conditioning
- Monitor physiology and activity (vital signs, oxygenation, biochemistry)
- Provide Communications
- Provide Life support
- Enable Mobility

Developments in future spacesuits will be at the forefront of smart clothing developments.



Heating and Cooling

Space suits generally include active heating and cooling systems employing fluid circulating thin pipes integrated into the inner garments, with the fluid then passing through a temperature control unit.

Based on these kinds of technologies ESA already commercialises body cooling suits - the McLaren suit and Motorcycle heating/cooling jacket.

MIT researchers have been exploring Skin-tight Biosuit which uses over pressure instead of inflation to protect against the vacuum of space. The standard approach to space suit protection against vacuum conditions is a pressurised suit container for the astronaut. This makes movement, particularly of the hands and fingers, very difficult (since the wearer has to work against the results of inflation pressure). A new concept is space suits incorporating controlled skin compression to replace 'inflated' suits – Mechanical Counter Pressure Suits. In effect these suits are specially reinforced outer skins whose pressure effects on the body counter the vacuum. A pressurised torso and heat element is usually added. Such suits need to incorporate temperature control and physiological monitoring. The pressurisation may be passive or active.

The ESA Star Suit Programme at Tampere University of Technology (TUT) Finland aimed to integrate physiological monitoring and wireless communications in a compact system.

The body exercising suit 'Regent' was developed by the Russian Institute for Biomedical Problems

This elasticated suit follows on from the original 'Penguin' suit. The suit has a potential for exploitation for sports injuries. The 'Regent' suit is a follow-up of the 'Penguin' suit, which was developed to avoid muscle loss in cosmonauts in space. 'Regent' consists of a number of elastic bands and acts as a full body expander that one can individually regulate. Therefore normal movement results in resistance training, which is the key issue in space, since gravity (which normally provides this) is absent.

This increased resistance training therefore operates as a long term work out. In sports training there is evidence that similar types of system assist athletes in the development of physiological and muscular strength.

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