

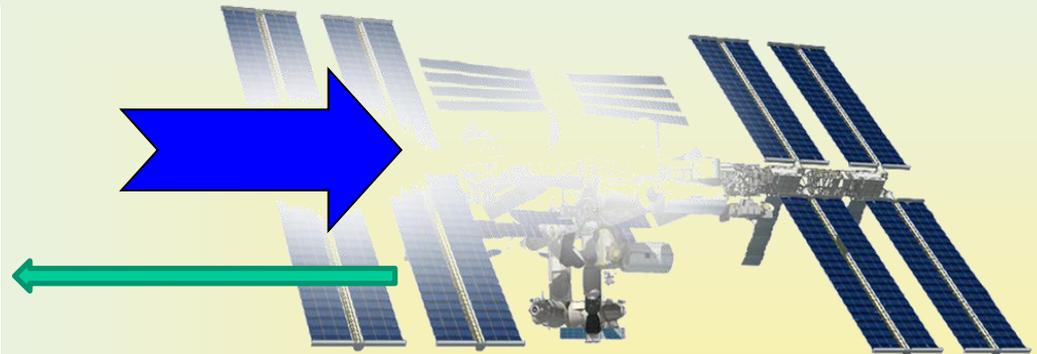
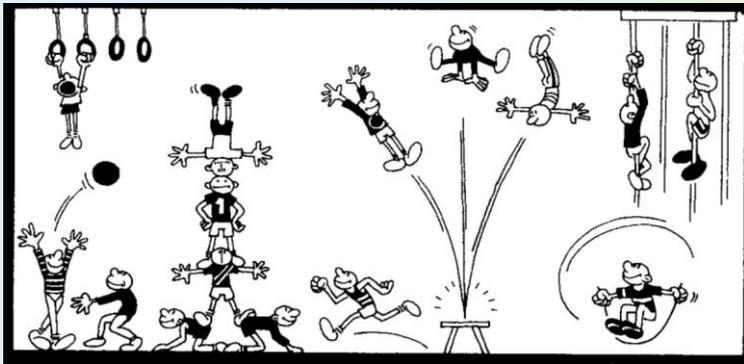
ISGP, Trieste  
14.-19.6.2010

# Countermeasure exercise on ISS - European Concept



Nora Petersen

Exercise Specialist  
Crew Medical Support Office  
ESA/EAC, Cologne, Germany



# Long duration space missions on ISS



## Countermeasure exercise objectives and requirements

- Ⓢ **Maintain crew member health, wellbeing and performance (before, during and after flight)**
  - Ⓢ Minimize impacts which could affect station systems, general safety or experimental set-ups
  - Ⓢ Adapt to ISS and microgravity specific requirements and maximize outcome (results, experience, systems, hardware, strategies...)
  - Ⓢ Explore new/better possibilities to optimize countermeasure support for long duration missions

# ESA Long duration missions on ISS



Astrolab: **2006** Jul-Dec (Thomas Reiter)



E1 Columbus: **2008** Feb-Apr (Leopold Eyharts)



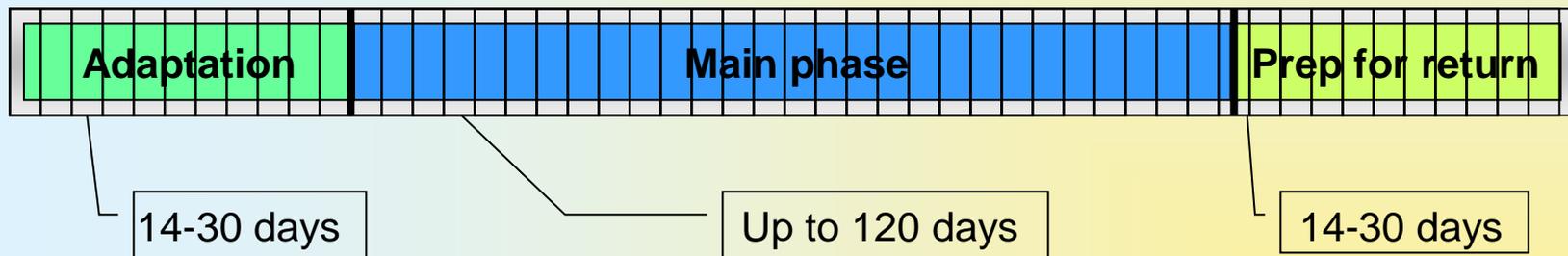
OasISS: **2009** May-Dec (Frank de Winne)

# ESA Mission Training phases

## Pre-flight



## In-flight



## Post-flight



## Mission preparation (pre-flight)

- ④ Maintain or develop above average fitness level of crew member
- ④ Create overall physical stability (core/spinal stability, endurance and strength, flexibility, agility)
  - ④ Long term (various) sports experience and fitness
- ④ Prepare for specific ISS training (ARED, T2, CEVIS)
  - ④ Training facilities in JSC only
  - ④ Protocol development
- ④ Readiness for EVA
  - ④ Include EVA preparative exercises
- ④ Physiotherapy - preventative treatments
  - ④ Physiotherapist strongly integrated in all phases of mission (and outside missions on regular basis)
- ④ Fitness Assessment



# ISS Countermeasure Training (in-flight)



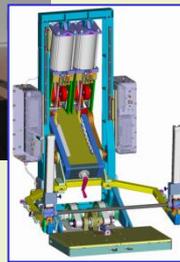
T2

2<sup>nd</sup> gen. Treadmill



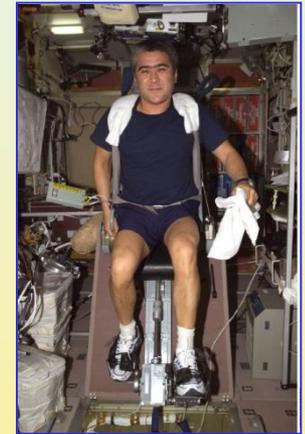
ARED

Advanced Resistive Exercise Device



CEVIS

US Bicycle Ergometer



VELO

Russian Bicycle Ergometer

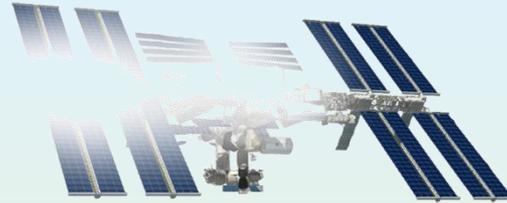
Back-up

TVIS

IRED

Images: © NASA

# European Selection



(A)RED

TVIS/T2

CEVIS

PFE



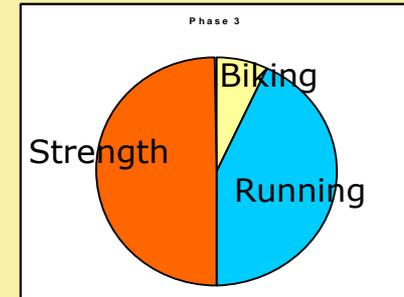
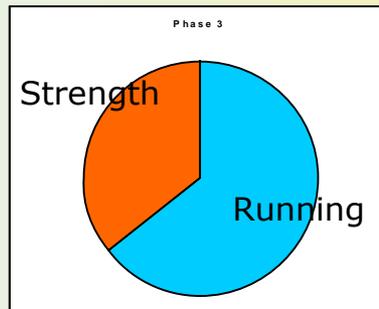
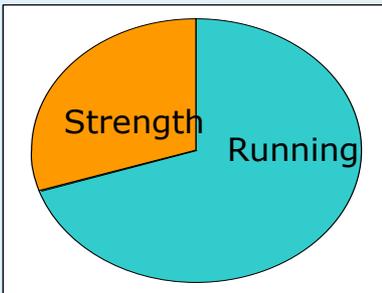
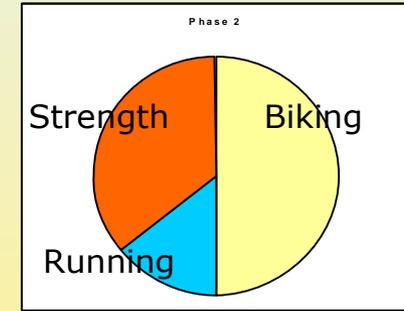
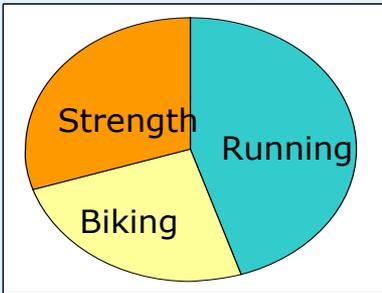
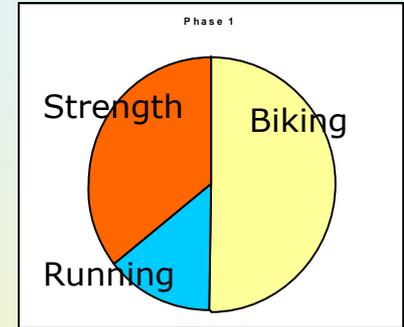
MO-3



VELO

TVIS

MO-3





# LDM2 2008 - ESA CMS plan

## Phase 1

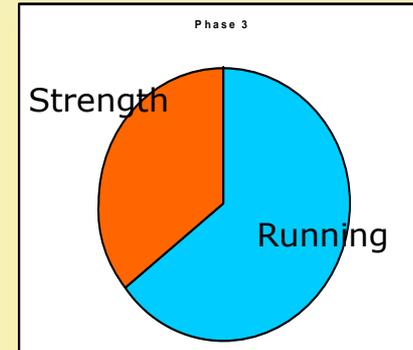
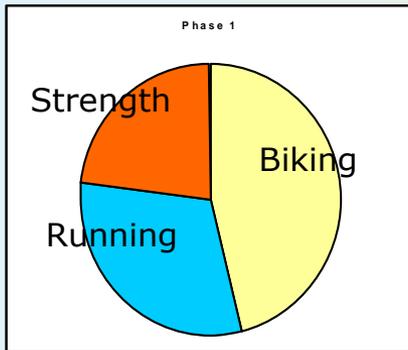
<b>Phase 1</b>	Mo	Run	Bike
	Tue	Bike	Strength
	Wed	Run	Bike
	Thur	Bike	Strength
	Fri	Run	Bike
	Sat	Bike	Strength
	Sun	Run	Bike

## Phase 2

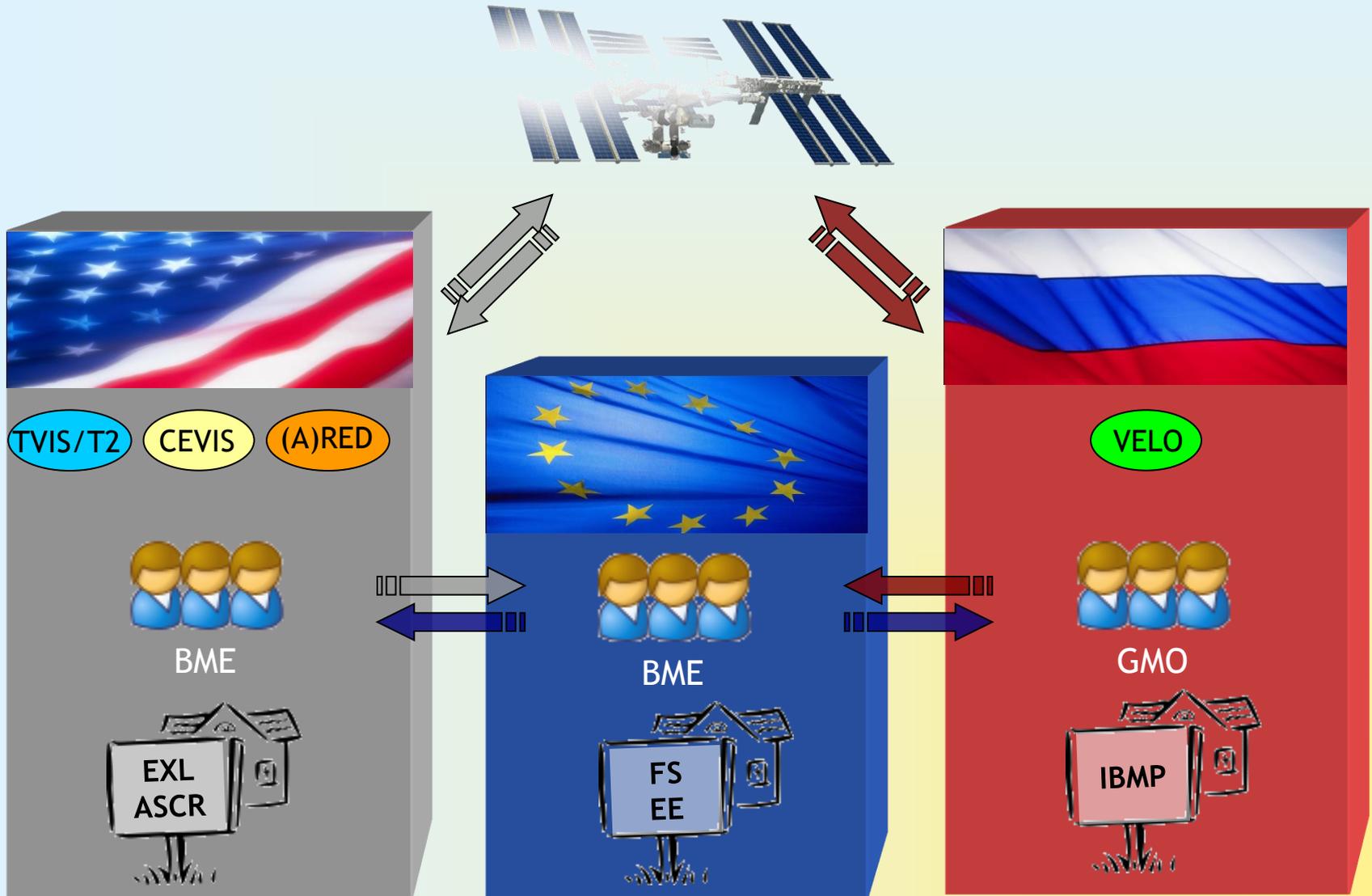
<b>Phase 2</b>	Mo	Run	Bike
	Tue	Bike	Strength
	Wed	Run	Strength
	Thur	Run	Bike
	Fri	Bike	Strength
	Sat	Run	Strength
	Sun	Run	Bike

## Phase 3

<b>Phase 3</b>	Mo	Run	Strength
	Tue	Run	Run
	Wed	Run	Strength
	Thur	Run	Strength
	Fri	Run	Run
	Sat	Run	Strength
	Sun	Run	Strength



# Implementation Structure



# Operational challenges

- Ⓢ Variability of exercise programs on ISS
  - Ⓢ Limitations by hardware
- Ⓢ Technical requirements (i.e.vibration, power, noise, 3-sec-reps)
- Ⓢ Availability of training devices (in use/failed)
- Ⓢ Scheduling challenges
  - Ⓢ Pre/post-sleep vs working-hours (DPC-DPC)
  - Ⓢ Work-rest schedule operational constraints
  - Ⓢ Docked ops (transfer, robotic arm ops, EVA)
- Ⓢ Interference with experiments
- Ⓢ Training intensity and objective
- Ⓢ Crew member compliance
- Ⓢ Communication and data exchange



## Post-flight rehabilitation

**Objective:** Strengthening of deconditioned systems and areas, achieve complete physical recovery and full re-integration into activities of daily life, promoting long-term health

ESA Rehabilitation consists of 2 elements:

**Physiotherapy** (support regeneration, individual treatments, strengthening and stabilization)

**Physical Exercise** (rebuild cardio-vascular, musculo-skeletal, neuro-muscular and functional performance)

Both elements cover all aspects with different methods, applying a balanced approach of various training stimuli and recovery, triggering a comprehensive physical re-adaptation



# Post-flight rehabilitation

## Acute Phase

**Period: R + 1- R + 21**

**Fitness Assessments**

## 2nd Phase

**Period: R + 22 – R + 45**

**Fitness Assessments**

## Long term follow-up



Physiotherapy

Sports-rehabilitation





# ...Questions...?



# Back-up slides



# LDM3

## Phase 1

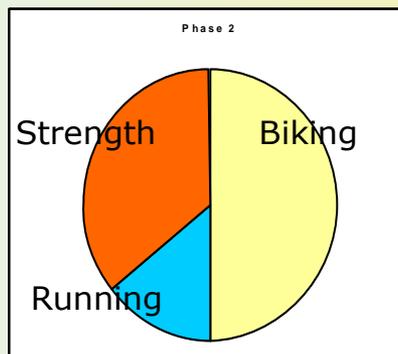
Phase 1	Mo	Strength	Bike
	Tue	Running	Bike
	Wed	Strength	Bike
	Thur	Strength	Bike
	Fri	Running	Bike
	Sat	Strength	Bike
	Sun	Strength	Bike

## Phase 2

Phase 2	Mo	Strength	Bike
	Tue	Running	Bike
	Wed	Strength	Bike
	Thur	Strength	Bike
	Fri	Running	Bike
	Sat	Strength	Bike
	Sun	Strength	Bike

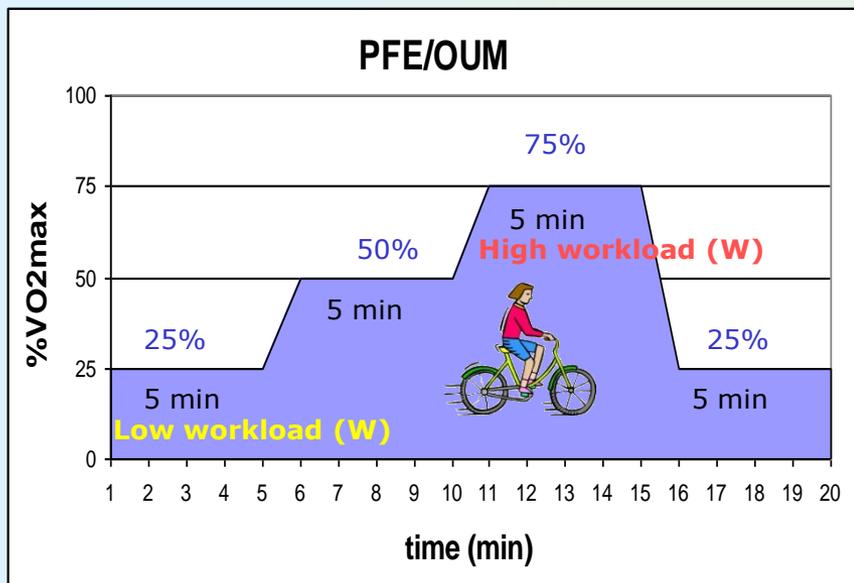
## Phase 3

Phase 3	Mo	Running	Strength
	Tue	Running	Strength
	Wed	Running	Strength
	Thur	Running	Strength
	Fri	Running	Strength
	Sat	Running	Strength
	Sun	Bike	Strength

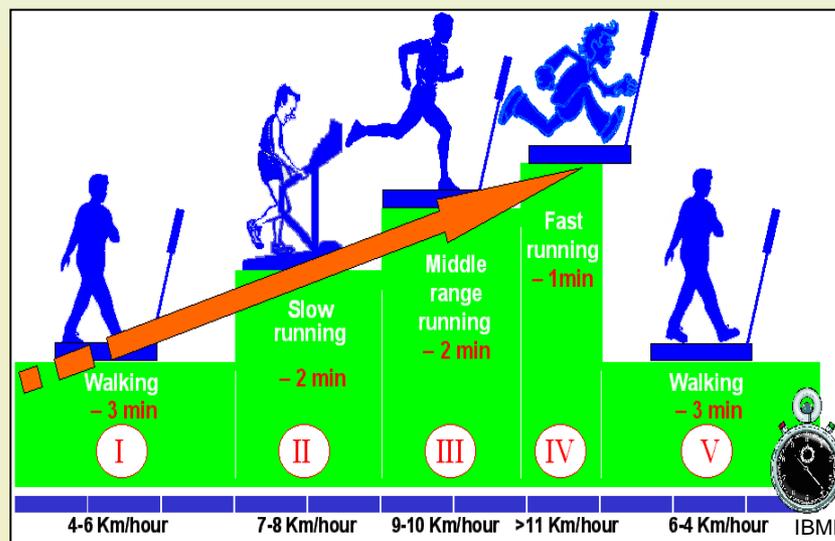


# Physical Fitness Assessments

PFE OUM



MO-3



# Life long physical exercise support

## Platform for

- Ⓜ Safe data exchange
- Ⓜ Training protocols
- Ⓜ Fitness test feedback
- Ⓜ Sport facilities
- Ⓜ Health information
- Ⓜ Photo gallery
- Ⓜ Announcements
- Ⓜ Training documents

The screenshot shows the F.A.S.T. website interface. At the top, there is a navigation bar with links for Home, CMSO, BME, MPTU, MedOps, and ESA Medical Board. Below this, a version and status bar indicates 'Version: Published (42.0)' and 'Status: Published and visible to all readers'. The main content area is titled 'Inspire, Facilitate, Support' and includes a navigation menu with items like 'Astronaut Pages', 'Photo Gallery', 'F.A.S.T. Blog', and 'F.A.S.T.n Active'. An announcement titled 'Your next challenge!!' by Nora Petersen is displayed, accompanied by a photo of a forest. The right sidebar features the F.A.S.T. logo and a photo of an astronaut on a treadmill.