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Summary Of The Science Performed Onboard The International Space Station During Increments 12 and 13

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- Increment 13 Science Execution & Accomplishment
- A Quick Look At The Upcoming Increments (Increments 16 and 17)
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- Acknowledgments
Often, it is thought by many in the scientific community that only the construction task is taken place on the International Space Station. This presentation hopes to shed some lights on the amount of science that has been performed on the ISS during the construction phase of the ISS

The objectives of this presentation are four-fold:

- To briefly review the science performed on the ISS during the previous fifteen Increments (Increments 0 to 15)
- To compare the original science complement plan for increments 12 and 13 with the on-orbit science accomplishment to illustrate the challenges of performing daily science activity on a space platform that is being built and staffed continuously
- To discuss the investigations that were conducted on ISS during Increments 12 and 13 (the discussion will focus mainly on the primary objectives of each investigation)
- To briefly discuss the science research complements that are being planned for Increments 16 and 17
Science Performed on the ISS over the last Seven Years

Increments 0 to 15: New Experiments

- Life Science, 39, 32%
- Fluid Physics, 3, 2%
- Fundamental Biology, 8, 7%
- Materials Science, 34, 28%
- Space Products & Development, 20, 16%
- Radiation, 5, 4%
- Human & Environment Interaction, 2, 2%
- Education & Earth Observation, 11, 9%

Increments 0 to 15: Continuing Experiments

- Life Science, 73, 29%
- Fluid Physics, 11, 5%
- Fundamental Biology, 2, 1%
- Materials Science, 60, 25%
- Space Products & Development, 44, 18%
- Education & Earth Observation, 37, 15%
- Radiation, 4, 2%
- Human & Environment Interaction, 13, 5%

Increment 0 to 15: Combined (New & Continuing Experiments)

- Life Science, 112, 31%
- Fluid Physics, 14, 4%
- Fundamental Biology, 10, 3%
- Materials Science, 94, 26%
- Space Products & Development, 64, 17%
- Education & Earth Observation, 48, 13%
- Radiation, 9, 2%
- Human & Environment Interaction, 15, 4%

NASA Grand Total of Experiments Performed on ISS From Increments 0 to 15

- Combined, 366, 50%
- Continuing, 244, 33%
- New, 122, 17%
Science Planning Generic Milestones Template

- CPHS = Committee for the Protection of Human Subjects
- HRMRB = Human Research Multi-lateral Review Board
- ICB = Informed Consent Briefing
- BDC = Baseline Data Collection

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Increment 12 Flights/Stages Planning Overview

Original Plan

- **Stage 11S**
  - Sep '05: 9/27
  - Oct '05: 10/22
  - Nov '05:
  - Dec '05:
  - Jan '06:
- **Stage 12A**
  - 12/8
  - 12/21
- **Stage 12A.1**
  - 2/9
- **Stage 12S**
  - 3/22
  - 3/30

Modified Plan

- **Stage 11S**
  - 10/5
  - 12/21

Final Plan

- **Stage 11S**
  - 10/3
  - 11/7
  - 12/23

- **Stage 12S**
  - 2/2
  - 4/1
  - 4/8
## Investigations Performed in Different Disciplines during Increment 12

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Increment 13 Flights/Stages Planning Overview

Original Plan

Stage 12S
- Mar '06: 3/30
- Apr '06: 4/9
- May '06: 4/24
- Jun '06: 6/19
- Jul '06: 6/28
- Aug '06: 8/28
- Sep '06: 9/5

Stage ULF1.1
- May '06: RS EVA (U/R)
- Jun '06: US EVA (U/R)
- Aug '06: US EVA (U/R)

Stage 12A
- Jun '06: 20P (Undock)
- Jul '06: 22P (Dock)
- Aug '06: 12A (Dock)
- Sep '06: 12S (Undock)

Final Plan

Stage 12S
- Mar '06: 3/30
- Apr '06: 4/9
- May '06: 4/24
- Jun '06: RS EVA (U/R)
- Jul '06: 6/26
- Aug '06: 7/4
- Sep '06: 9/9

Stage ULF1.1
- Jun '06: 20P (Undock)
- Jul '06: 22P (Dock)
- Aug '06: STS-121 (Dock)

Stage 12A
- Jul '06: STS-121 (Dock)
- Aug '06: ULF-1.1 (Dock)
- Sep '06: 12S (Undock)
## Investigations Performed in Different Disciplines during Increment 13

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# Investigations Currently Being Performed in Different Disciplines for Increment 16

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## Investigations Currently Being Performed in Different Disciplines for Increment 17

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Science Performed (or will be) in Different Disciplines on ISS from Increments 0 to 17

**Increments 0 to 17: Projected New Experiments**
- Life Science, 41, 31%
- Fluid Physics, 3, 2%
- Fundamental Biology, 8, 6%
- Materials Science, 38, 29%
- Radiation, 5, 4%
- Space Product Development, 23, 17%
- Human & environment Interaction, 2, 2%

**Increments 0 to 17: Projected Continuing Experiments**
- Life Science, 89, 31%
- Fluid Physics, 13, 4%
- Fundamental Biology, 4, 1%
- Materials Science, 66, 22%
- Radiation, 6, 2%
- Space Product Development, 59, 20%
- Human & environment Interaction, 15, 5%

**Increments 0 to 17: Projected Combined (New & Continuing) Experiments**
- Life Science, 130, 30%
- Fluid Physics, 16, 4%
- Fundamental Biology, 12, 3%
- Materials Science, 103, 24%
- Radiation, 11, 3%
- Space Product Development, 82, 19%
- Human & environment Interaction, 17, 4%
- Education & earth Observation, 57, 13%

**Increments 0 to 17: Projected Total Experiments That Will Be Performed on ISS**
- Combined, 428, 50%
- New, 132, 15%
- Continuing, 296, 35%
Science Performed in Different Disciplines on ISS for each Category (Increments 0 to 17)
The main purpose of this presentation was to make the science community aware of the many investigations that have been conducted and continued to be performed on the ISS over the last seven years.

To show that science has been performed on ISS in a wide spectrum of science disciplines and yielded many interesting results that are changing or improving our understanding of some of the phenomena and theories in these fields.

It was shown that a total of 122 new investigations and 244 continuing ones will be performed by the end of Increment 15 (for a grand total of 366 investigations by the end of Increment 15).

With the currently planned investigations for the next two increments (Increments 16 and 17), it was shown that a grand total of 428 investigations will be performed by this time, next year.

All this research is being accomplished while the station is still under the construction.

Based on these facts, the prospect for the station as a science research platform once the construction phase is over, is, indeed, quite bright.
Acknowledgments

The author would like to thank Mr. Roger Weiss for providing information relating to crew time and ascent research upmass, including the on-orbit rack facilities information.

Also, the author would like to thank all the Astronauts who spent time conducting science on ISS during the last seven years, and specially those who unselfishly gave their weekend and off duty days to perform additional science for the scientific community.

Finally, the author would like to thank Astronauts William S. McArthur, Jr. and Jeffrey N. Williams, whom he worked with as their increments Lead Scientist (LIS) during Increments 12 and 13. Both of them gave up many hours during their weekends to perform much needed additional science during their ISS tour of duty.