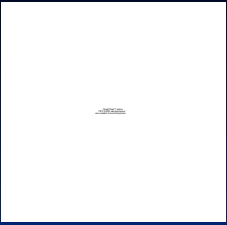
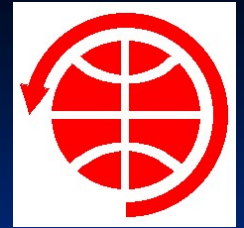


**Proposed
Modification of
the ISS-HAM HF
antenna (WA4)**

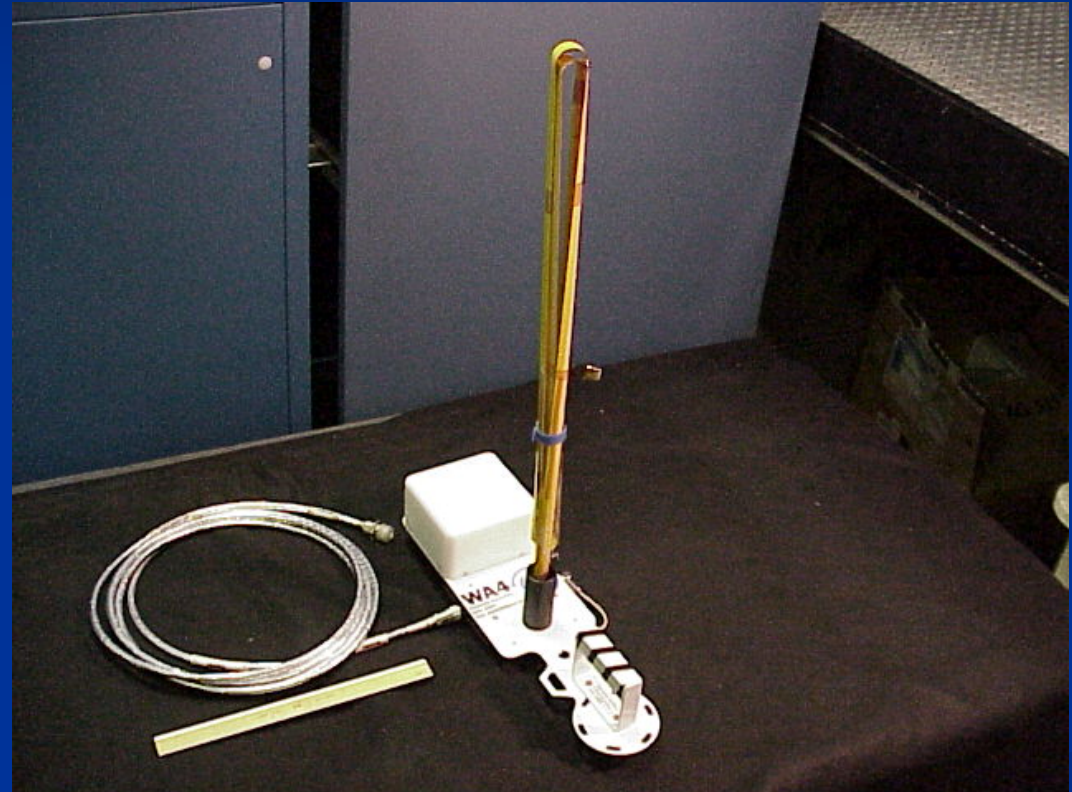
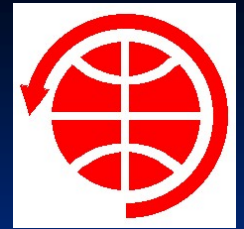


WA4 Antenna



- The design of the current ISS-HAM HF antenna was based on some incorrect assumptions.
 - The SM (Service Module) was a metal cylinder.
 - The HF antenna would be grounded to the SM sufficiently to provide a ground plane for the antenna.

WA4 before delivery to ISS



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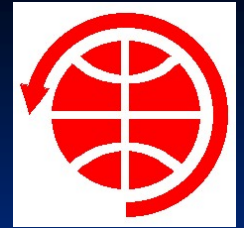
WA4 HF antenna as installed



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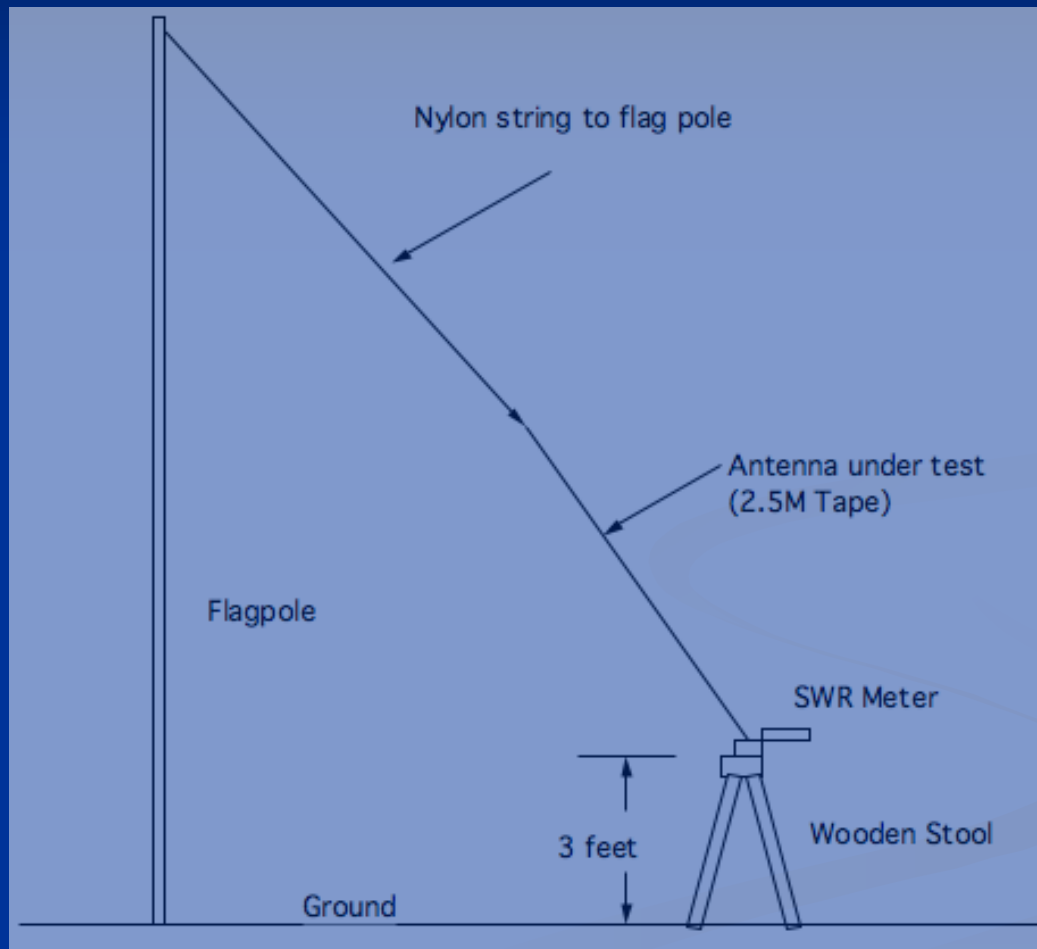
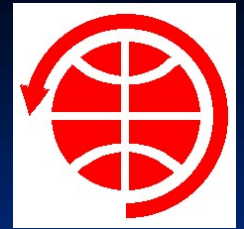
Suspensions were confirmed



- We had some concerns about the antenna's suitability.
- Early plans for the FT100 included a tuner.
- The absence of the opportunity to perform an End to End test fueled those concerns.
- We decided to do some tests in the best setup we could reasonably come up with.

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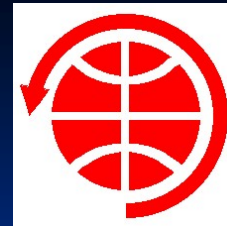
Test Setup



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Test Setup (AMSAT style)



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Test Data



Data taken at Test stand at Energia

| Frequency MHz. | SWR | X(R) | X(Z) |
|----------------|-----|------|------|
| 28 | 3.6 | 27 | 44 |
| 14.23 | 9.7 | 7 | 32 |
| 7.5 | 25 | 2 | 11 |
| 21.3 | 7 | 149 | 169 |

Orlando Without Extra element

| | | | |
|------|------|-----|-----|
| 28.6 | > 31 | 0.1 | 168 |
| 21 | >31 | | |

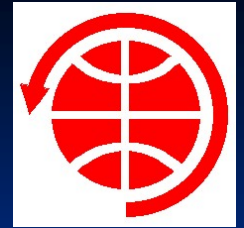
Adding a new Antenna Element



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Tests With Extra Element



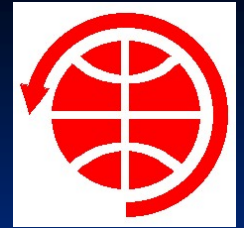
With Extra Element (98")
Frequency MHz.

| | SWR | X(R) | X(Z) |
|-------|------|------|------|
| 28.6 | 1.1 | 47 | 0 |
| 28 | 1.2 | 38 | 17 |
| 28.2 | 1.3 | 42 | 10 |
| 28.4 | 1.1 | 44 | 3 |
| 28.6 | 1 | 47 | 0 |
| 28.8 | 1.1 | 52 | 8 |
| 21.2 | >31 | 2 | 167 |
| 24.9 | 12.7 | 3 | 94 |
| 18.1 | >31 | 7 | 230 |
| 14.23 | >31 | 41 | 329 |
| 7.1 | >31 | 0 | 806 |

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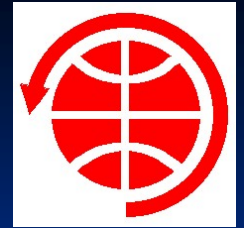
October 10, 2006

Conclusions



- We need to fix this problem before any HF capability is added to the ham station on ISS if there is going to be any transmission.
- We can only transmit on the 28Mhz band.

How do we fix this problem?



- An EVA is the only practical solution.
 - A simple element has been designed that could be easily installed during an EVA for other reasons.
- A Tuner will not be enough because of the hazard that standing waves on the coax cable would pose.



Recommendation



- Proceed with the Design Fabrication and Test of a flight approved antenna element.
- Include this element with the next ISS-Ham Equipment shipped to ISS.
- Schedule the installation on a Russian EVA as an add on task.

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