

# STARCS

Experimental Aerodynamics

Member of Sjöland & Thyselius Group



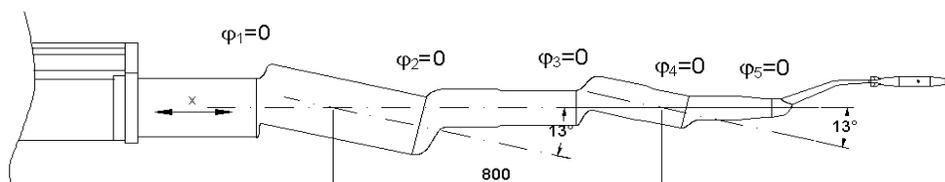
## STARCS Store Release Simulation Rig

A two-sting rig for store release testing has been designed, built and commissioned at STARCS (former FOI/FFA) the T1500 wind tunnel. The rig has six degrees of freedom and has been designed with a new working principle. It consists of one linear bearing

and five rotating joints of which two are inclined  $13^\circ$  to the axial direction.

The axial stroke length of the two-sting rig is 750 mm and the maximum radius from the straight line is 350 mm with the store parallel with the sting pod.

Principle and definitions of the store release simulation rig



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The two-sting rig is mounted on the sting pod of the wind tunnel model support. This means that the store will always have the same pitch angle as the parent aircraft. As a result the required adjustments of store angles during a test are limited to compensate for deflections in stings and balances caused by air loads. The rig was designed for the following loads referred to the centre of the store balance:

### Design loads referred to the balance

Normal force: 300 N Pitching moment: 10 Nm  
Axial force: 50 N Yawing moment: 10 Nm  
Side force: 300 N Rolling moment: 3 Nm

When the store position in relation to the parent aircraft is calculated, the deflection in both the sting and balance of the parent aircraft as well as the deflection in the trajectory rig and its balance is considered. The following static setting accuracies have been verified:

### Verified accuracies

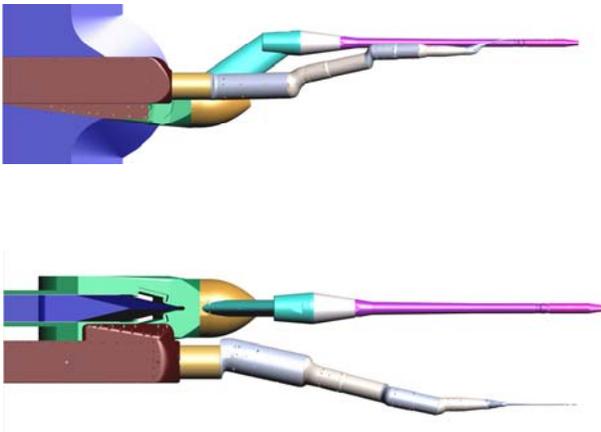
$$\Delta x = 0.1 \text{ mm} \quad \Delta \Phi = \Delta \sigma = 0.05^\circ$$

$$\Delta y = \Delta z = 0.3 \text{ mm} \quad \Delta \phi = 0.1^\circ$$

Although the store is positioned close to the parent aircraft at the start of the trajectory it should not come in contact with the aircraft model, which could occur especially at high angles of attack due to model vibrations. If the store anyway comes in contact with the parent aircraft the control system will immediately detect this and withdraw the store.

Data acquisition is continuous while the store performs a linear motion either in the x-direction of the aircraft (missile release) or the vertical direction of the wind tunnel (bomb release). The two-sting rig control system can be programmed to perform any required trajectory.

As an example the figures below show a typical rig setting. The store has been moved 200 mm vertically and 200 mm to the starboard side and a small pitch angle to compensate for the deflection in the parent aircraft sting has been added. To accomplish this setting the following relative settings at each joint were used:



$$x_{rig} = 174.4 \text{ mm}$$

$$\phi_1 = -91.78^\circ$$

$$\phi_2 = 99.94^\circ$$

$$\phi_3 = 0.17^\circ$$

$$\phi_4 = -93.46^\circ$$

$$\phi_5 = 85.30^\circ$$

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