



Shutter redundancy IRD Requirement
Tech Note
Wednesday, 01 August 2001
SPIRE-RAL-NOT-000776



To: Gary Davis, Bruce Swinyard
CC: John Delderfield, Don Peterson, John Hackett, Joe Taylor, Dwight Caldwell
RE: Bruce's email of Tuesday 24 July.

When I returned from the shutter PRD meeting, I passed on to Bruce the main outcomes of our meeting. One of the matters I related to him was the Shutter team's reluctance to incorporate a shutter that relaxed to the out of beam position upon failure.

The "obvious" means of incorporating this facility into the design of the shutter is to spring load the vane and operate it without a gear box. The show stopping problem with this scheme is that the ohmic losses in the motor would cause so much dissipation to Level 1 that the FPU structure would over heat.

I have given this problem some thought and have come up with a possible solution. It is described in Figure 1.

The shutter in the normal in-beam state is shown at the bottom view in Figure 1(i). Gear A is fixed to the output shaft of the 90° gear box. Gear B (labelled in Figure 1(iii)) is constrained from rotating relative to the shutter. Gear B is spring loaded so that if the constraint is removed, it will tend to rotate anticlockwise (as viewed). In normal operation, the shaft rotates and the torque is transmitted to the shutter via the gear set and the shutter opens and closes as seen in Figure 1(i) and (vi).

Upon either failure of the motor (prime and redundant!) or seizure of the gear box. The rotational; constraint on Gear B is removed and the spring force will cause it to rotate anticlockwise and return the shutter vane to the open position. This design relies on the shaft either being jammed or the detent torque on the gear box being a sufficient inertia.

By supplying this conceptual design, I am not saying that it should be incorporated in the design. It is however an option to be evaluated and could act as the baseline for quantifying the system impact of fulfilling the IRD requirement using the current shutter design.

Some of the costs of including this in the design are as follows:

1. Need for the provision of some form of extra solenoid to release Gear B.
2. The associated need for extra pins in the harness. (currently not available)
3. Extra mass
4. Lower eigenfrequency
5. increased complexity
6. possible beam obscuration by Gear A

I await your comments.

Douglas Griffin
1 August 2001

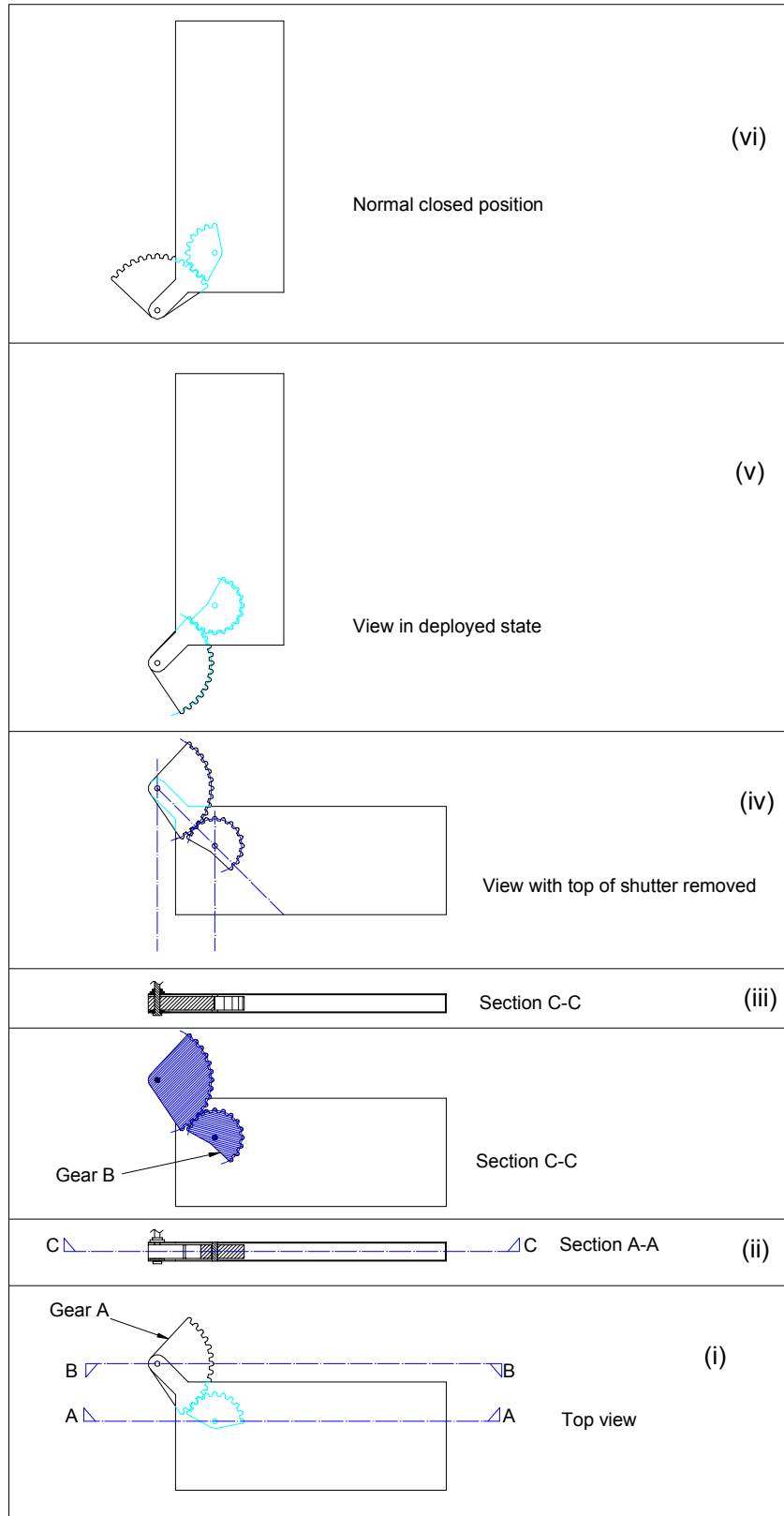


Figure 1 -Possible solution for incorporating a second means of opening the shutter.