CSM31 / CRS31 Catalysts :

The choice to maintain high performance S.R.U. operations in presence of B.T.X.

J.L. Ray Axens

Experiments conducted in ASRL Calgary by
P.D. Clark, N. Dowling and M. Huang

Contents

- **Aromatic hydrocarbons: Benzene,Toluene and Xylene B.T.X. = a major problem in SRU**
- **Performance of Claus catalysts in the presence of Toluene under first converter conditions**
- **How to manage Carsul formation**
- **Performance of CRS31 in the presence of B.T.X. when used in commercial bed configuration:**

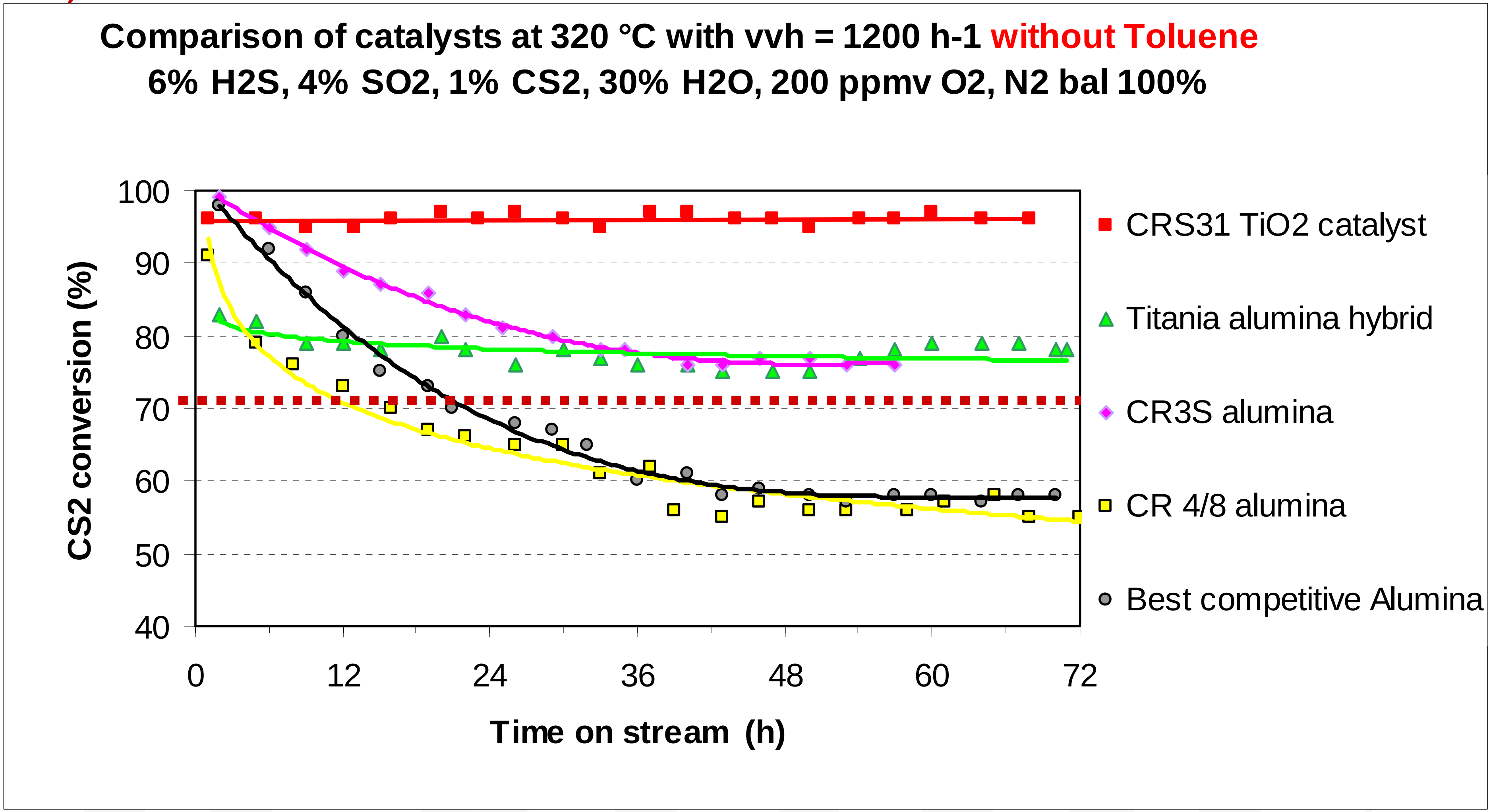
CSM 31 / CRS 31

The problems of lean acid with B.T.X.:

- Low front end furnace temperature :
  - high CS_2 and COS content
  - split flow operation necessary
  - Unreacted B.T.X. go straight to catalytic converters
    severe fouling + quick deactivation

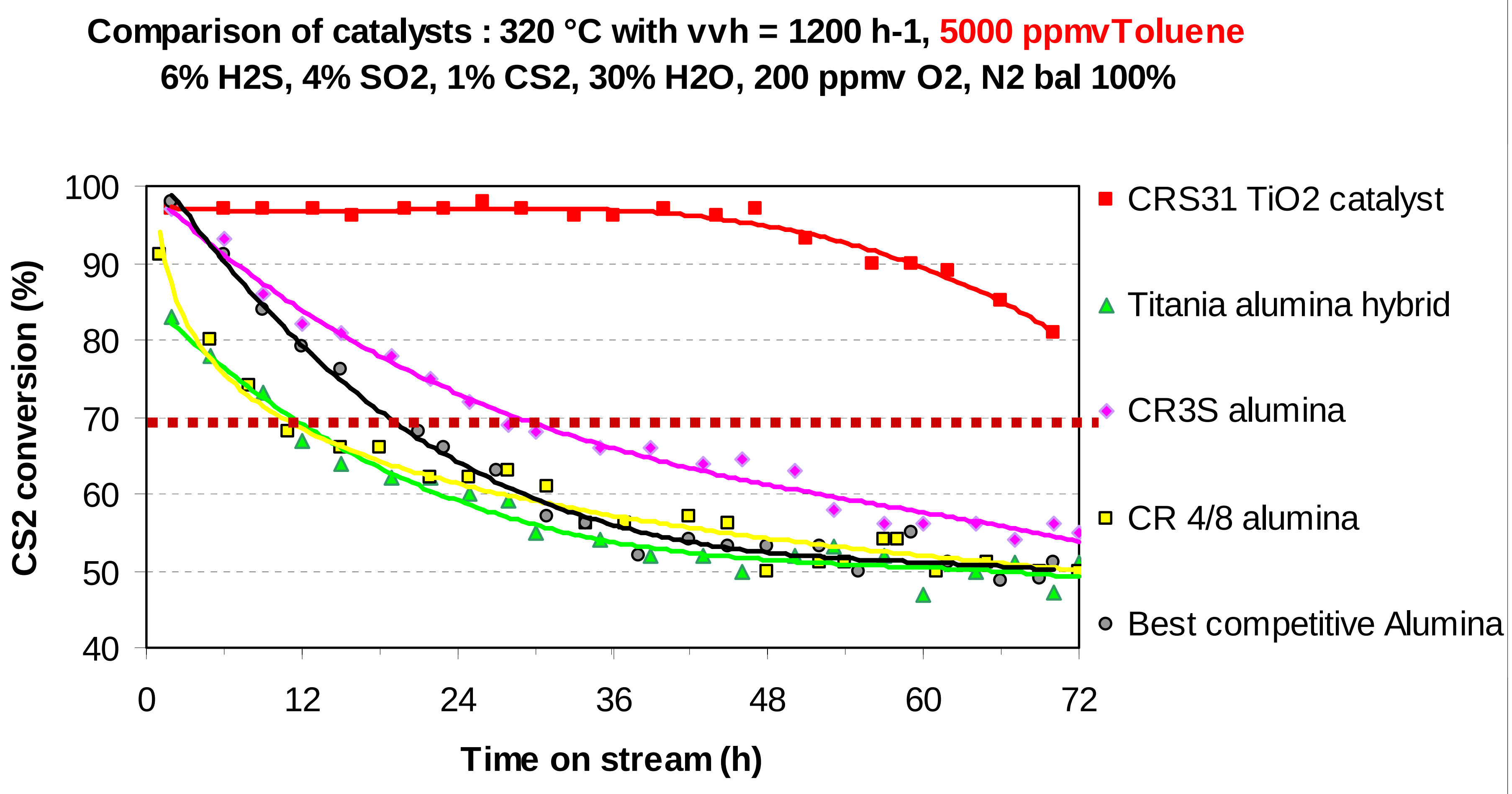
➡ **Low catalytic performances**
Very short lifetime

ASRL Experimental work without B.T.X.



➢ **CRS 31: best performances and no deactivation**

ASRL experimental work with B.T.X



- With Toluene : quick deactivation / severe fouling

Conclusion :CS_2 conversion with Toluene

- **CRS 31:**
  - ***the most efficient catalyst anyway***
  - ***deactivation occurs suddenly after 48 hours***

- **ALUMINAS:**
  - ***deactivation begins at S.O.R.***
  - ***CS_2 conversion is very low***
  - ***more efficiency = more sensitive to deactivation***

- **TITANIA ALUMINA HYBRID:**
  - ***acts more like alumina***

CRS 31 is the best catalyst,

But it has to be protected by a top layer!

Carsuls formation increases with....

- Temperature increase (James Hyne 1982)
- Temperature increase (ASRL studies 2002)
- The presence of sulfates (« «)
- Lower H_2S/SO_2 ratio (« «)

Carsul formation rate increases in the order :

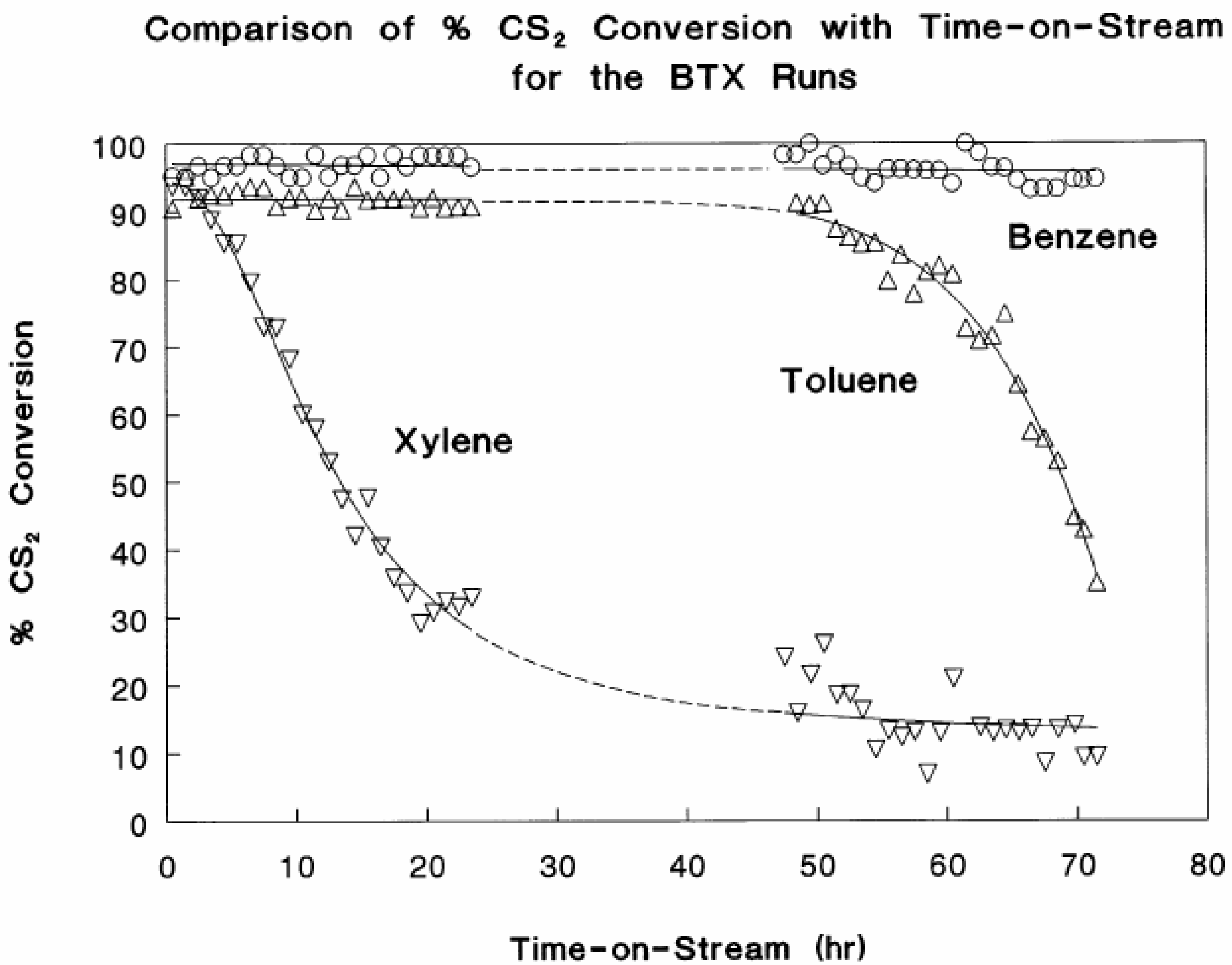
Benzene : 1

Toluene : ~3

Xylenes : ~10

P. Crevier et al., , LRGCC, Norman, OK, 2001 February

Effect of individual contaminants



To manage B.T.X. poisoning :

1: Operate R1 at the lowest possible outlet temperature without decreasing COS/CS2 conversion :

⇨ **Pure titanium dioxide : CRS31**

2:Prevent the formation of sulfates by increase H_2S /SO_2

$$SO2 + 3\ H2 \longrightarrow H2S + 2\ H2O$$

3 : Use Water gas shift conversion which produces H_2 continuously:

$$CO + H_2O \longleftrightarrow H_2 + CO_2$$

4 / Convert nasty Toluene and Xylene to "more friendly" Benzene (hydrodealkylation)

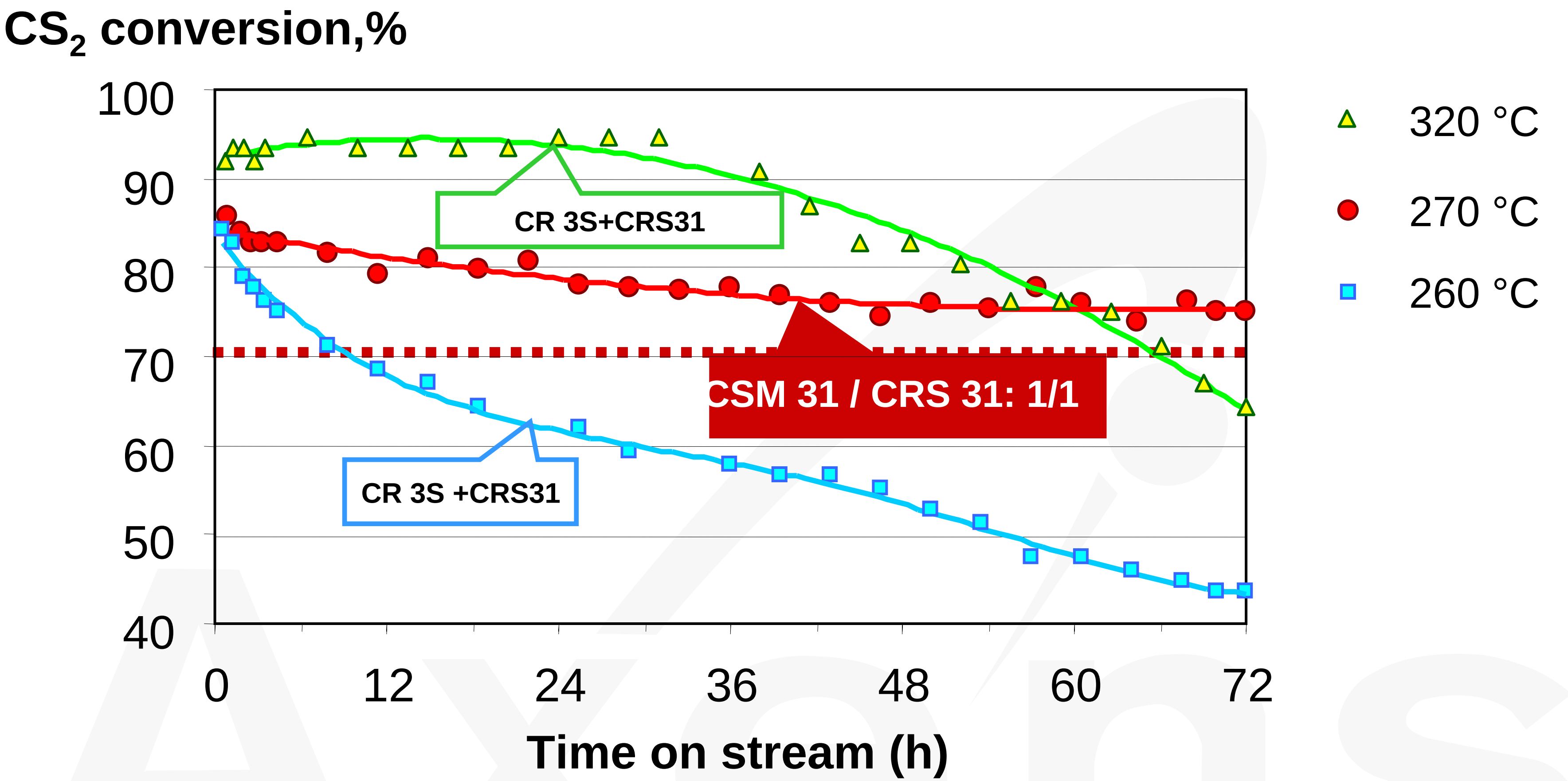
Patented catalyst : CSM 31

BTX Management with CSM31 + CRS 31

Dual bed CR 3S / CRS 31= 1 / 9 vs. CSM 31 / CRS 31= 1 / 1 - VVH = 1300 h-1

H_2S/SO_2 = 1.5 - CS_2 = 12% and COS = 8% of sulfur species

CO = 2.26% - H_2 = 1.26% - BTX (7.5/5/1) = 2000 ppmv industrial gases



Conclusions

When BTX cause you troubles:

1/ Operate R1 at the lowest possible T°C

2/ CRS 31 is the most efficient catalyst versus Claus reaction and COS/CS_2 hydrolysis.

3/ Use a protective layer with 3 fonctions : increase H_2S/SO_2 ratio ,achieve water shift conversion and hydrodealkylate aromatics

CSM 31 / CRS 31 dual bed is the solution!

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