3 NoU 1981:11, "The *Alexander L. Kielland* Accident" (in Norwegian), The Commission of Inquiry's report, Mar. 1981.
4 Moan, T., Berge, S., and Holthe, K., "Analysis of the Fatigue Failure of *Alexander L. Kielland*," ASME Winter Annual Meeting, Washington, D.C., Nov. 1981.

DISCUSSIONS

K. Yoshida[1]

The leg D of the *Alexander L. Kielland* is connected to the main structure by the six members as shown in Fig. 4. I consent to the story, which is the main body of this paper, up to the stage of the fatigue failure of the bracing D6.

It is not, however, so easy for me to understand the successive stage of the ductile overload fracture of all the remaining five members without some of the following situations:

1 The stress levels of the remaining five members are considerably high, even if the bracing D6 exists.
2 An important member of the remaining five members has some structural defects similar to the bracing D6.
3 The remaining five members with the leg D cannot behave as a stable truss, and the high bending moment occurs in each of these members after missing the bracing D6.

I would like to know the calculated maximum member stresses in the case of the intact condition and also in the case of missing the bracing D6 under the environmental condition corresponding to the disaster occurrence.

M. Kawahara[2]

This paper provides detailed and selected points for the *Alexander L. Kielland's* failure. It will aid in interpreting similar accidents which may occur in the future. I would like to have some additional explanation on how you determined the values of stress concentration factors as given in your text: $K=1.6$ for intact fillet welds, $K=3.0$ for fillet welds completely fractured, and $K=2.5$ for fillet welds fractured in quadrants I and II.

The authors show the fatigue life calculated only for the intact fillet welds. I would like to hear the author's opinion on the effects of the partial cracking of double fillet weld to the fatigue life.

Only a short description is given on the pure fatigue mode crack growth from the hydrophone at the end of your paper. Did the authors attempt to calculate the crack propagation life? If so, what is the estimate, and what are the authors opinions on the role of crack propagation in the estimation of fatigue life?

Authors' Closure

Reply to K. Yoshida by A. Almar-Naess

The maximum stresses in the bracings from stillwater loading and waves were calculated by the Inquiry Commission, reference [3] and were as follows:

1 Platform intact and in a typical state of operation:

Lower horizontal bracing	C6	154 MPa
	DE	113 MPa
	D6	184 MPa
	E6	161 MPa
	5-6	218 MPa
	AE	125 MPa
Diagonal bracing	4D	−123 MPa
	3D	− 97 MPa

2 Bracing D6 missing, with weather conditions at the time of the disaster:

Lower horizontal bracing	AB	248 MPa
	A5	173 MPa
	B5	229 MPa
	C5	75 MPa
	C6	104 MPa
	DE	949 MPa
	E6	110 MPa
	5-6	111 MPa
	AE	198 MPa
Diagnonal bracing	4D	−858 MPa
	3D	1230 MPa

Available information indicates that the diagonal bracings 3D and 4D failed shortly after the fracture of D6, as a result of axial tension and bending, respectively.

There is no information to show that any of the bracings had structural defects previous to the failure of D6. The platform has recently been turned into its upright position, and the investigation now to follow might give further particulars.

Reply to M. Kawahara by P. J. Haagensen

1 In the Commission of Inquiry's report (reference [3] in the paper), the results of a fracture mechanics calculation of the growth of cracks from the partially cracked welds are given. The calculations are highly sensitive to the assumptions made regarding initial crack length and stress spectrum. The general conclusion was that the crack growth stage from the time a through-thickness crack was present to total fracture of D6, could have occupied at most 6 to 12 mo, but the actual time period could well have been only a fraction of this.

2 The stress concentration factors in brace D6 at the hydrophone were computed using the finite element method.

3 The term "pure fatigue mode" is applied to the part of the fracture surface (of brace D6) where the fracture surface is smooth without the bands of coarse, fibrous surface associated with overload fracture. The occurrence of these bands are indicated in Fig. 10 of the paper.

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